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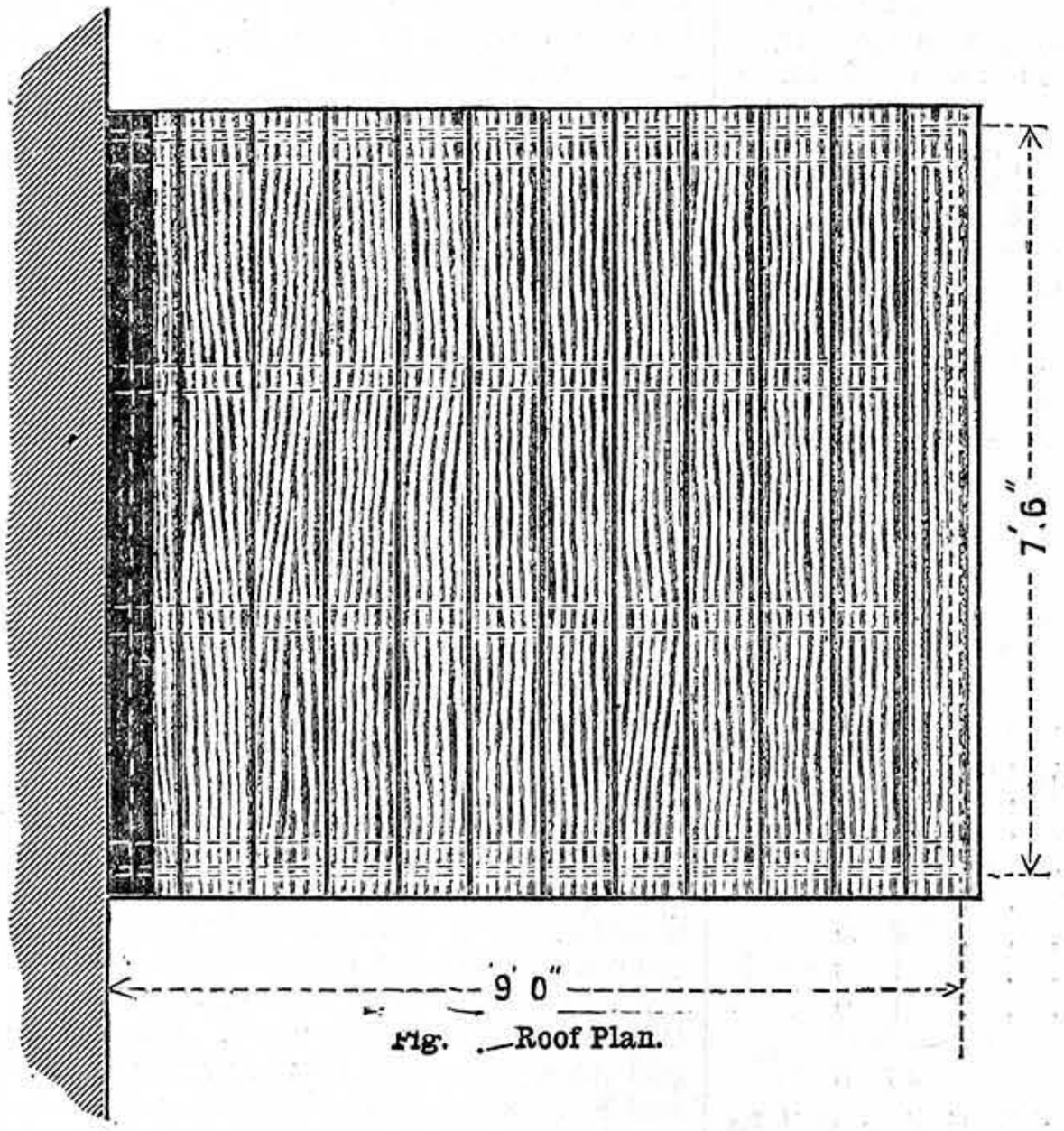


Fig. .—Roof Plan.

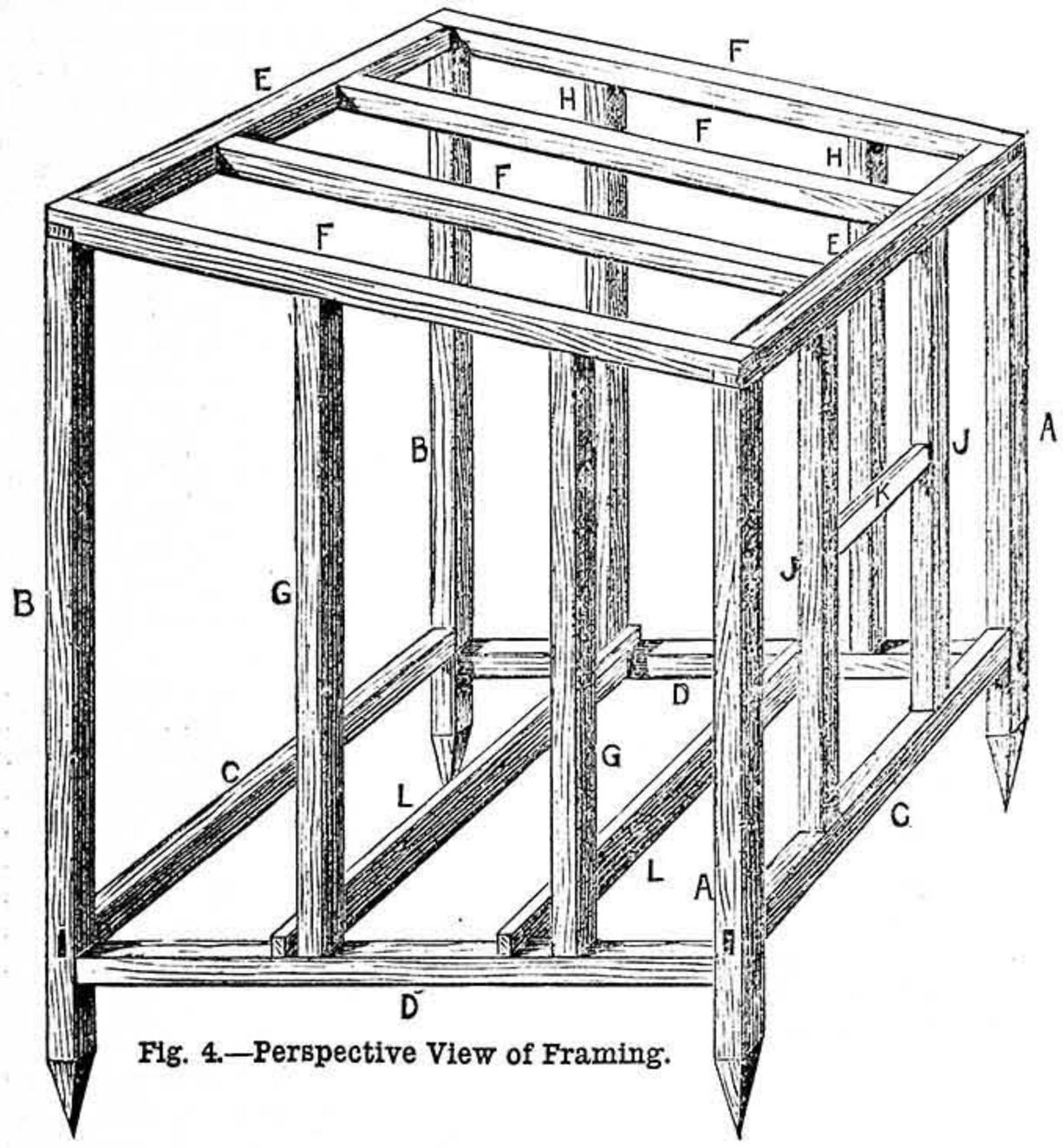


Fig. 4.—Perspective View of Framing.

Fig. 2.—Side Elevation.

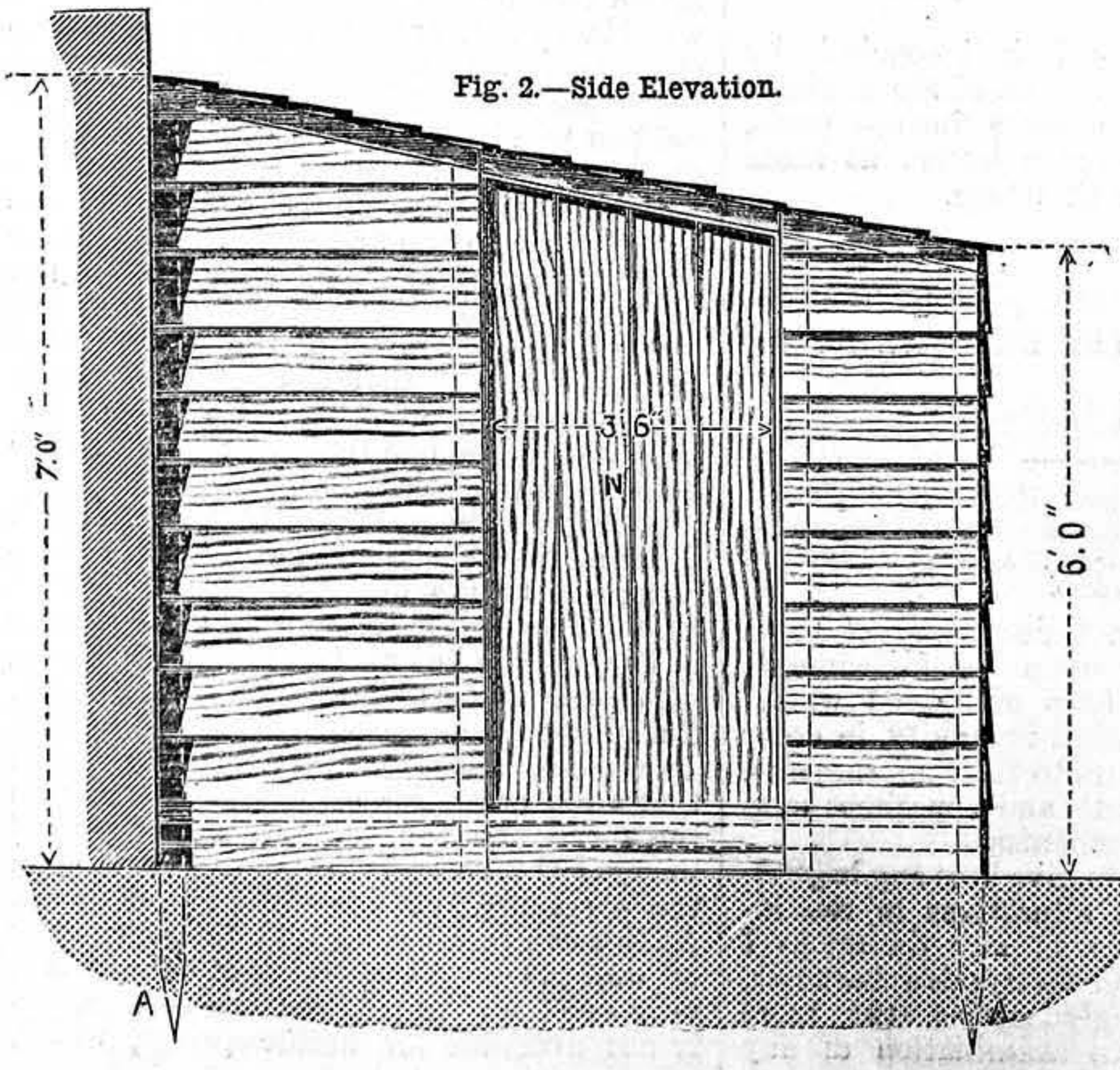
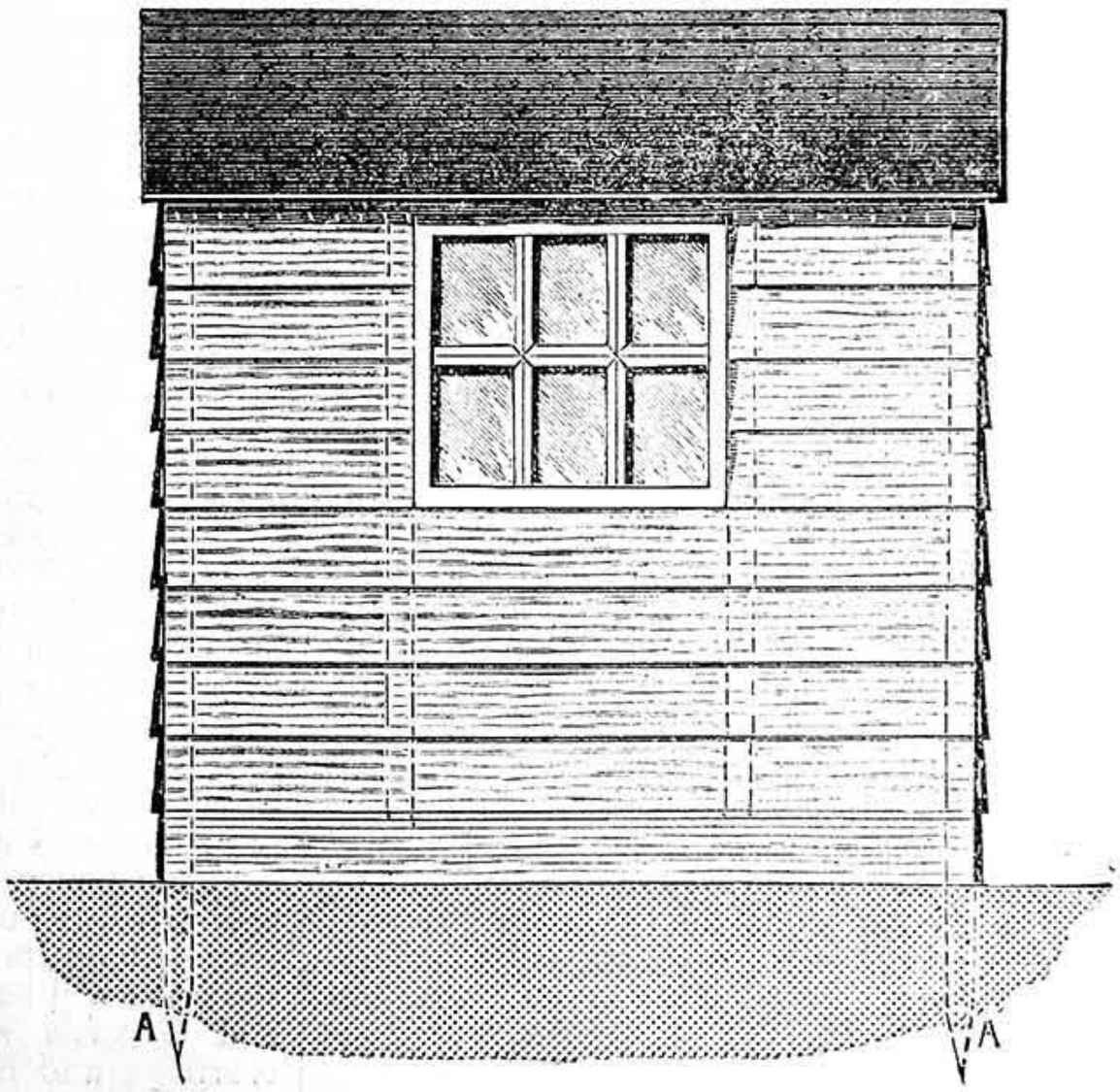


Fig. 3.—Front Elevation.



A CYCLE HOUSE.

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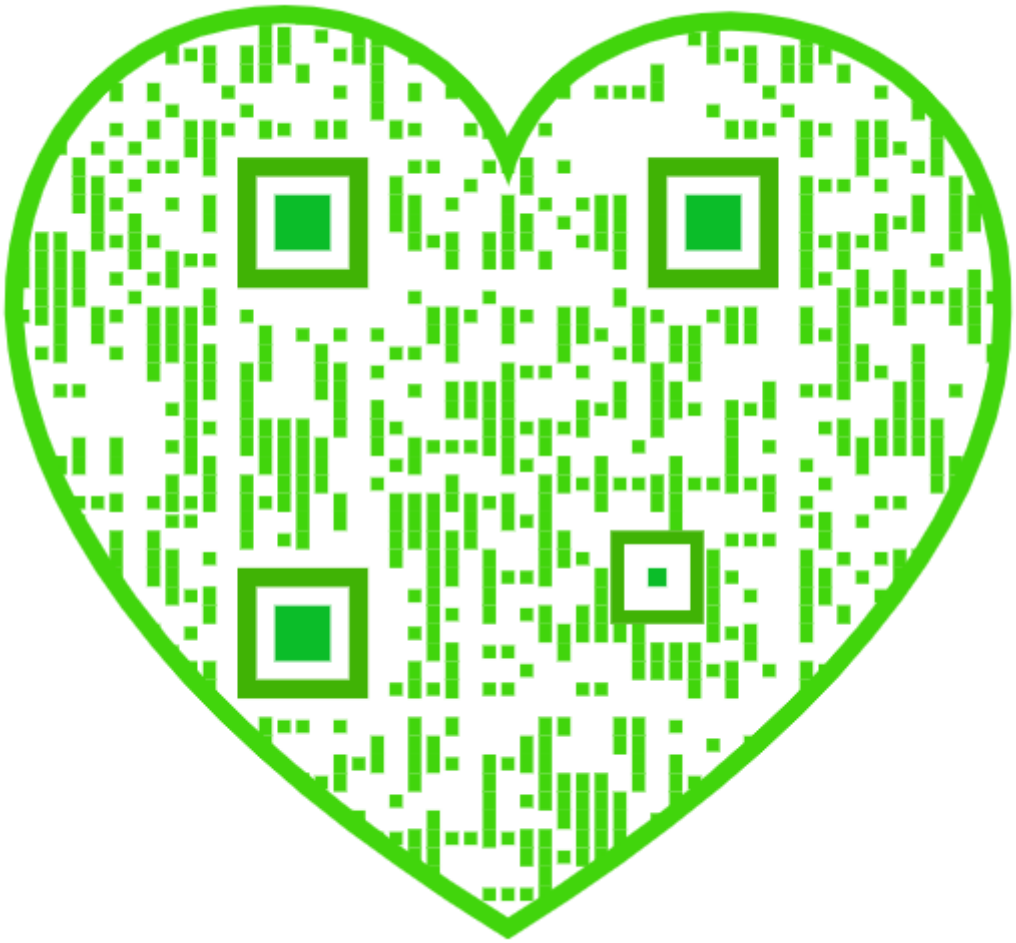

A CYCLE HOUSE.

BY J. H.

STORAGE OF CYCLES—GENERAL VIEWS OF HOUSE—MAIN FRAMINGS—BOARDING—PORTABILITY—COST—QUANTITIES REQUIRED.

Storage of Cycles.—Cycles, and especially tricycles and tandems, are awkward things to store away in the little houses occupied by working people in the towns. Some kind of shed is indispensable. The wash-house, or scullery, or kitchen is out of the question. It is a pity to use the green-house; a fowl-house is not nice; so a special place is almost indispensable. Such sheds are advertised at somewhat high prices, prices that are prohibitory to many young cyclists. I will show how a shed can be made for less than half the price of one of these, provided the cyclist is a bit handy with common tools. I propose to describe in detail a fairly large one of my own, made a couple of years ago. It contains a cripper tandem, a cripper tricycle, and two safeties—one full-size, the other a lad's machine. The house measures 9 ft. by 7 ft. 6 in., and cost less than £3 for materials, and being well tarred will stand for as many years as I and mine shall be likely to want it. A house of half the size would hold a tricycle and a safety, or three safeties, and the cost would be reduced in exact proportion to size.

General Views of House.—The general construction of the house is shown in Figs. 1, 2, 3, 4. Fig. 1 is a roof plan, Fig. 2 a side elevation, Fig. 3 a front elevation, and Fig. 4 a perspective of the main framework, given to assist amateurs to a clear understanding of the method of its construction. It is a lean-to shed, a wall occupying one side. In my case the roof slopes *towards* the wall, but as in most instances it would be more convenient to allow it to slope *away* from the wall, I show it thus in the sketches. The low wall against which my house leans happens to carry an oblong rain-water tank on the top, and the rain runs off the roof into the tank; hence the reason why I so built it.

Main Framings.—The main frames of the house are made of spruce quartering, having a cross section of 3 in. by 2¾ in. They are these (Figs. 1, 2, 3, 4):—

Four uprights (A, A, B, B), four horizontals (C, C, D, D), two roof horizontals (E, E), and four rafters (F, F). These are all mortised and tenoned strongly together, as I will show in detail in the next article. Upon the way in which the work is done, the stability of the house largely depends.

There are also two uprights (G, G) of the same cross section, 3 in. by 2¾ in., that form the posts of the door. Also two uprights (H, H) to afford a central support to the boards on that side of the house, and two uprights (J, J) and a cross-bar (K), between which a window-sash is placed.

There are two joists (L, L), having a cross section of 6 in. by 1 in., fixed on and between the horizontals, D, D. These carry the flooring boards, of ¾ in. spruce. The house is therefore quite dry and clean.

Boarding.—The framework is covered over with spruce boards, ⅜ in. thick by 9 in. wide, overlapped about an inch at the joints, and nailed to the quartering and to each other. The roofing boards are covered with felt, well tarred. The door (N) is made of 1 in. spruce boards battened together.

Portability.—This house is built in such a way that it can be taken down and removed with the least waste of material possible. It is also economical, as the following account will show.

Cost.—The cheapest way to buy timber in moderate quantity is to purchase it in a deal or deals, and pay for sawing. Spruce deals measuring 11 in. by 3 in. cost fourpence per foot "run"—that is, fourpence for each foot in length. Sawing costs from 2s. to 2s. 6d. per 100 ft. superficial. Now the quartering is made by cutting a 3 in. deal into four strips—that is, three shallow cuts. ⅜ in. boards are made by cutting a 3 in. deal into six—that is, five *deep* cuts. In the first case a 12 ft. deal would cost at 2s. per 100 ft. about 2½d. for sawing. In the second a 12 ft. deal would cost 1s. 1d. for sawing.

Now for quantities required.

Quantities required.—Running through the dimensions given in the figures, we see that about 160 ft. of 3 in. by 2¾ in. quartering are required. Dividing this by four, it means that 40 ft. of 11 in. by 3 in. is wanted, and this will cost 160d. plus, say, 9d. for sawing—total, 14s. 1d.

Of ⅜ in. stuff we shall want about 220 superficial feet, equivalent to about 40 ft. of 11 in. by 3 in. at fourpence, costing 13s. 4d.; sawing this will cost, say, 4s. ¾ in. flooring board, 7 in. wide and 1 in. thick, costs from ¾d. to 1d. per foot run, according to quality. About 150 ft. run will be wanted for floor and door—say, 150 times ¾d.—roughly, 9s. 6d.

An old sash can be bought for 1s., a pair of hinges and padlock for 1s. 6d., nine yards of felt for 4s., two gallons of tar for 1s., and six pounds of various nails for 1s., so that our account stands thus:—

	s.	d.
Quartering	14	1
⅜ in. stuff	13	4
Sawing do.	4	0
Flooring, etc.	9	6
Sash	1	0
Hinges	1	6
Felt	4	0
Tar	1	0
Nails.	1	0
	49	5

And every scrap of this timber will be new and clean, and sawn to thickness. The prices, too, are not the lowest possible. In some seaport towns lower prices can be figured.

In the next article I shall conclude by giving a detailed description of the methods of union adopted in these various parts, using the same reference letters as those employed in the present article.

REPAIRS TO FLUTES, CLARIONETS, ETC., THAT MAY BE DONE BY AN AMATEUR.

BY B. A. BAXTER.

INTRODUCTION—PADS AND PADDING—SPRINGS—CLARIONET MOUTHPIECES—REEDS—SOME REMARKS ON THE CLARIONET AND ITS HARMONICS—CRACKS IN THE WOOD.

THE flute-player, or, indeed, any of those musicians who play upon the instruments grouped under the term of "wood wind," have need of mechanical ingenuity, in order to effect trifling repairs to their instruments, which are very delicate, and sometimes complicated pieces of mechanism.

It is not intended to give here any instruction to effect radical alterations in the instrument or its fittings; any directions I shall give will be of a conservative character, and I most strongly advise the most thorough and careful examination of any defect before the player attempts to cure it. When a would-be player first invests in a new instrument—new in the sense of his own inexperience, though it may be second-hand—he cannot always afford to buy the best instrument of its class, nor one that bears the warranty of the firm who sells it. By the way, the mere imprint of maker or seller's name is not a warranty of perfect condition. The beginner may have to be content with one of those instruments imported from France or Germany, which are sold by music warehousemen and dealers generally. These instruments are usually good; they bear no name and are sold as received, the dealer accepting no responsibility on the subject—good, I ought to say, according to the price; and if the young flautist can get a friend with experience to select his flute, he may be well content to have what is called a warehouse instrument.

But we will suppose it bought, and some progress made in learning. Some tones appear too loud, some harder to produce than the rest, some too faint to be in keeping with the rest, some too flat, some refusing to sound at all. Now, some of these are due to the player's inexperience, some are curable defects, though I shall not pretend that all are within the control of the amateur.

Pads and Padding.—The flute or clarionet will not sound aright unless the pads close perfectly the holes they are intended to cover. Pads may be bought at moderate prices, according to material and size, from 3d. to 1s. per dozen. First test each piece of the instrument separately by stopping one end and the finger holes, blowing into the other end; if a little water is placed on each pad it will soon be evident if any of them leak. Look if there is any chip or dirt lodging in the hole or on its edges. See if the springs act perfectly to keep the key closed, and if no fault is discovered there the defect is probably in the pad; some of them are made of a skin or membrane, like gold-beater's skin; this in a short time wears on the sharp edge of the wood. Select a new pad from your stock of the proper diameter and thickness, and, having removed the key, make it hot at the end where the pad is fixed; this may be done in a gas-flame, or a composite candle will give heat enough. Avoid holding the key *above* the flame: this will blacken it, so that it will be difficult to clean perfectly; hold the key close to but below the flame, in order to warm it. The old pad will be easily removed and the new one fitted with either shellac, good sealing-wax, or even bicycle cement, preference being given to the first of these, and either being used very sparingly, for we do not want cement or anything else to spoil the softness of the contact of the pad with the instrument. See that the pad fits well and replace the key at once, while warm; the pad will more readily adapt itself to the hole it has to cover.

Springs.—The springs of each key, though differing in size, should offer about the same resistance to the finger, though this must be quite secondary to the duty of the spring in keeping the key air-tight. In open keys, which the finger and not the spring closes, the spring can be as slight as may be desired. To weaken over-strong springs, I have found that a pin or a piece of wire placed between the spring and the key, and gently pressed towards the root of the spring, will lessen the curvature, and, therefore, its resistance. As this can be done without taking the key off, and the effect can be felt at once, it is a very good way to regulate the springs. It is not available for needle-springs, which,

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however, do not so often require regulating. These I have at times regulated by merely pinching with pliers, so as to slightly reduce or increase the curvature as required. All this foregoing is applicable to any of the wood-wind family.

The Clarionet.—Now a few words about the clarionet, with which I am more familiar. A flute is a mere tube, in which a column of air is vibrated by the skilful way in which the player directs a stream of wind, neither wholly into nor outside the tube; the varying length of the air column is effected by the fingering.

In the clarionet, however, we have a reed vibrating outside an aperture smaller than itself, through which, therefore, it cannot pass: opening and closing this door-like arrangement with rapid, yet periodic, alternation, it produces a tone more or less musical. The tube, however, asserts its power to modify both the rapidity of the reed's movement and the quality of tone produced. Now, to do this it is important to have a good mouthpiece. The clarionet mouthpiece is a partly turned and partly carved wooden tube, in which the cylindrical hole in the end is gradually reduced to an aperture in the side of the mouthpiece, the reed resting on an almost flat surface, reduced from the original turned exterior.

A little consideration will show that this almost flat surface must be curved so as to allow the reed enough liberty of movement, that the shape of the curve must be such that the reed by its own flexibility, aided by the player's lips, will close the aperture. Hence the exact shape of the almost flat surface of the mouthpiece on which the reed rests depends on the stiffness of the reed and the strength of the player's lips. Here, then, is the reason of the difficulty in "laying" a mouthpiece, as it is called. Three varying factors contribute to the result, and must be brought into suitable relation to each other. Let no one think I wish to set all the young clarionet players to alter their mouthpieces; I do not. Had my reading some twenty years ago extended to repairs of this kind, I should have done much less re-laying, and better than I have sometimes succeeded in doing it.

Never try to re-lay a mouthpiece unless you have a good reed to try it with—a worn-out or badly cut-down reed will not do. Be sure to have the curvature of each side alike, or no certainty of tone can be expected, but an occasional piercing shriek may be foretold. After these warnings, you will expect to be told what to do and how to do it. If the clarionet will utter the lower sounds well, the opening between reed and mouthpiece is long enough; if it is hard to get some of the upper tones, the lay is too straight; if the very highest tones are impossible, it may be the fault of the reed, for I have proved that a reed cannot be made to vibrate more quickly by the tube to which it is affixed, though it can, and is, made to vibrate more slowly by the addition of the tube. I satisfied myself as to that by cutting the back out of a mouthpiece, so that there was really no tube; trying various reeds, I found various pitches, rising according to pressure of lip and wind, but in no case could I coax a reed to give a higher pitch on the complete clarionet than was possible on my mutilated mouthpiece. In order to prove whether a mouthpiece has its sides alike, the best plan is to obtain a piece of plate-glass, and holding it in contact with the flat part, test the opening with pieces of sheet-metal of even thickness, or pieces of note-paper, or even a postcard; if either lies obliquely, then the curvature is not alike on each side. In order to give some assistance as to the curvature of the mouthpiece, having measured a very satisfactory one, I find a white postcard will enter $\frac{3}{8}$ in., that the paper on which WORK is printed will enter $\frac{7}{8}$ in., and a buff postcard nearly $\frac{3}{4}$ in., while the reed and mouthpiece are in close contact an inch from the end of mouthpiece. But, as I have said, the reed and the lips of the player are factors in the result. A stiff reed requires less aperture; a flexible one more. By all means choose a reed as stiff as can be played with comfort; it is finer in tone and is more durable—moreover, it makes the high notes more certain.

The Reed.—Many players are not able to secure good reeds without trial; this is out of the question, but we may *look* at the reeds when we buy them. Hold a well-made reed up to the light, and the stouter part is seen to be opaque, while the thinner part is semi-transparent; that the change is gradual and equal on each side of the centre; see also the colour, which is an evidence of the ripeness of the cane—like the straw of corn, it is at first green, changing to a yellow, from lemon-yellow to orange or buff; avoid all greenish reeds or very pale lemon colour; also avoid dark yellow or buff-coloured cane. One is immature; the other is over ripe, and gives a splendid tone, but, alas! it is for a very little while, the cane soon losing the elasticity necessary to the best results. Try, therefore, to get reeds of a medium yellow tint; if the grain is well-marked, like a piece of wood, so much the better. A good reed will be found to retain its smoothness when wetted. If any get very rough when first put into use, throw them away, and avoid making your lips sore. A reed too stiff may be rubbed down carefully with a piece of "water of Ayr" stone moistened with water, which also, I ought to say, is useful to finish the lay of a mouthpiece, after the finest files have done their best to attain perfection.

Harmonics.—All the upper tones of wind instruments are due to harmonics: in the flute the octave is the first, and in the clarionet the twelfth is the first interval obtainable as the result of harmonics. The clarionet produces the odd series of harmonics; and, with the exception of *stopped* organ-pipes, I believe it is alone in this respect.

Cracks in the wood are best prevented: care in the use of either of these instruments will often prevent a crack which carelessness would certainly produce; avoid any unnecessary moisture, and wipe out the instrument as soon as playing is over; do not expose it in a moist condition to the influence of heat, and treat it to a trace of oil occasionally, which may be of a drying character, in the inside. Be sure not to let any drying oil go on the pads; let them remain clean, or if stiff from watery moisture, use a little vaseline, which may also be used to lubricate springs, but apply it very sparingly, or the instrument will collect dirt very quickly. If a crack should be noticed, it will probably begin on the outside: stop it at once. If the wood is greasy, perhaps marine glue is the best, or shellac varnish; but if not greasy, fish glue or best Scotch or Cologne glue would do well. If possible, get a turner to turn a shoulder and put on a ferrule; but by taking the precautions I have indicated, it is to be hoped nothing more will be required.

The above, I trust, will be found a very fair summary of the extent to which an amateur may reasonably proceed in repairing the two instruments mentioned.

BOOT AND SHOE REPAIRING.

BY WILLIAM GREENFIELD.

How to Re-welt and Re-sole Hand-sewn Work.

In this, my last article on "Boot and Shoe Repairing," I will deal with the two above subjects. They are certainly the two hardest that I have as yet put before you; but being the most important, or the two nearest approaching the making of a boot, it would be hard to say how important a part they will take in giving you a comprehensive knowledge of the more practical part of boot and shoe making.

You ought by this time to be pretty used to using the awl and thread, therefore, although the hardest, they ought to come far more easy than some of the minor repairs did, for in shoe repairing there is seldom a week passes without there are jobs of some kind to give a little practice and keep the hand in trim. But to proceed with the work in hand. It should be borne in mind that a last must always be put in and fitted well to the boot or shoe, or you will not be able to make them look well, and there is a *chance* of making them smaller. Pieces of stout leather can be put down on top of the lasts, or even pieces of bundle-of-wood stick will do, tapered at one end, and the thin end knocked in first; but then this must be done carefully, or the vamp may break just in front of the lacing. Fitting them up well in this form should make the bottom solid all over, and keep them in their proper shape.

A thin, long tack must be put in the back of the boot to keep the last in its place, as at A, Fig. 1; then put the sole and welt part in water, and when it is nicely wet take it out, wipe it, and cut the old sole off. This is done by putting a knife between the sole and welt at B, and continuing right along, round the toe, and down the other side to C. The old sole can then be cut away, cutting across from D to E if it is going to be a riveted or pegged graft, as shown in the first article (see WORK, Vol. III., page 113, otherwise No. 112), or from F to G if it is going to be a sewn graft.

In either case a small hole can be made in the old leather at H, and a piece of waxend put through, that it may be drawn down flat on to the top of the heel, securing it there by tying the thread round the nail at A. This keeps it in position while grafting, and also sewing in the welt. If you intend to welt it all round, carefully cut the old welt away from I to J, and take away, *pro tem.*, the bottom filling, K.

The next thing to be done is to fit the welt, which is a long strip of oil-dressed leather (price from a 1d. per pair). They must be buffed on the grain side, cut in two straight down the centre, tied in a knot, and put into water to get wet—thoroughly soaked, in fact, for they have to be used wet. But before they are ready for use they have to have an angular piece taken off the grain side, as shown at A B, Fig. 2. This will, when turned over (that is, grain side down), show an end as Fig. 2, A, and this is the position in which it is held while it is being sewn in.

You proceed with the sewing as shown in Fig. 3, starting by putting the thread in at A, then halving the thread, as shown before, and making a hole at B, and while the awl is in, place the welt against the upper at its point, and make a hole in it at I, as shown by the arrow in Fig. 2, A. You then put the bristle through first. that is in the left hand,

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and then the one in the right, and pull them both out, changing the bristles by this means into the reverse hands, and set the stitch as before explained. This you continue, as in Fig. 3, until you reach the old welt on the other side.

To sew in the welt, use a sewing-awl and a thread about the same substance; this, with a fair amount of wax, as the two ends have to go through the same hole, makes it solid.

When the welt is sewn in, hammer the seam down all round, giving firm blows, so as not to break or bruise it. Then carefully skive off any surplus stuff above the seam that may in any way make it uneven or clumsy, but do not cut near enough to the seam stitches to weaken them.

For repairs it is only necessary to skive the waste part (that is, the ends) of the welt a little thinner after they are sewn in, though it can, and therefore should, be done first; but a novice is apt to make them too thin, and weaken it where it should be solid, having to stand against the splice or graft in the sole. A piece of tapered bone should now be rubbed round between the upper and the welt, to make the welt flat to receive the stitches which the sole will have to be stitched on with. The edge of the welt must now be rounded up to the shape required. Generally it does not need to have much taken off, only just a little here and there, to make it a good shape, for a pair of welts when split in two is nearly always the necessary width, but at places the stitching somewhat contracts it, and thus leaves prominent parts, which are best cut off, and, as shown by the dotted line in Fig. 3, is always a little too wide at the waist.

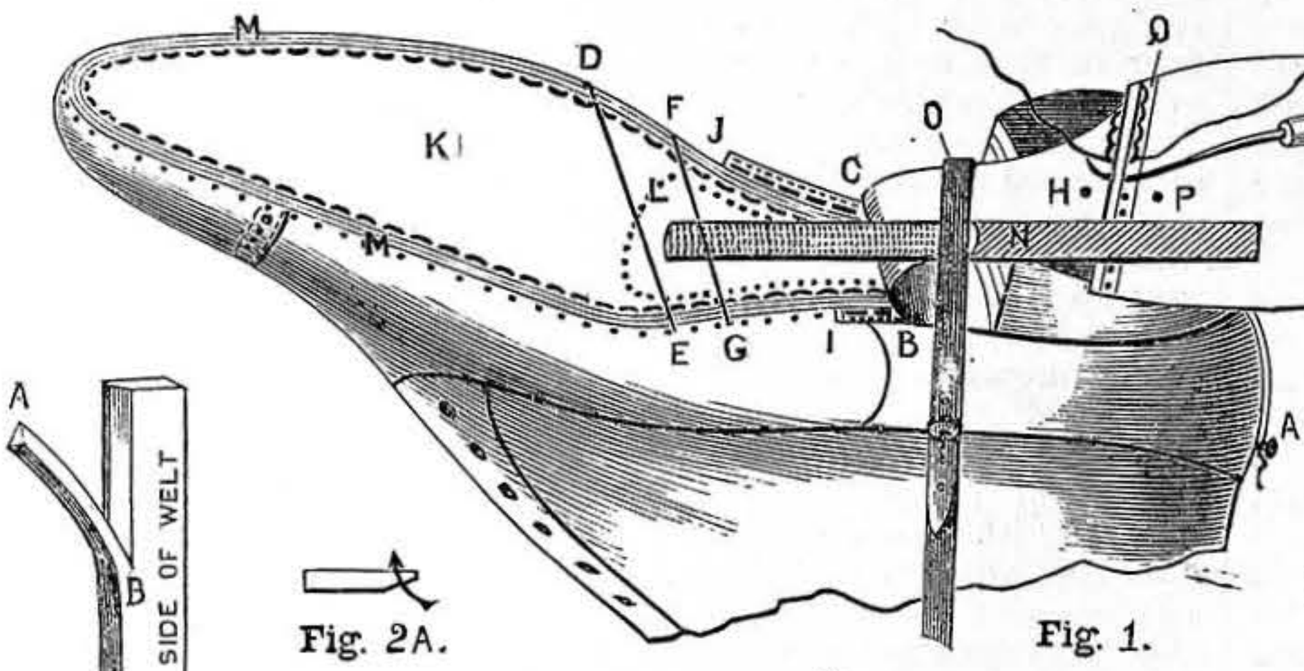

Fig. 1.

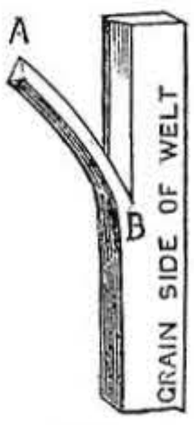

Fig. 2.

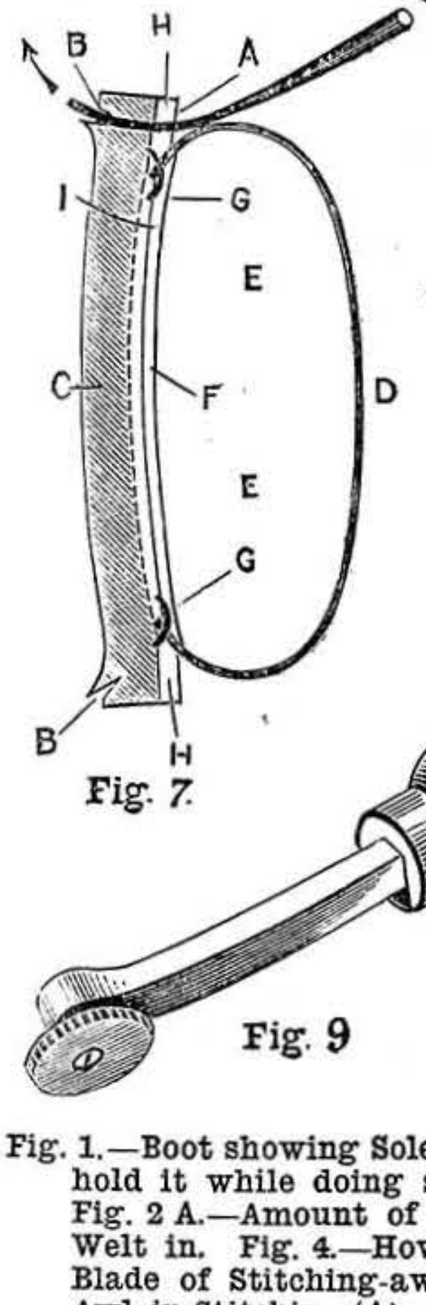

Fig. 7.

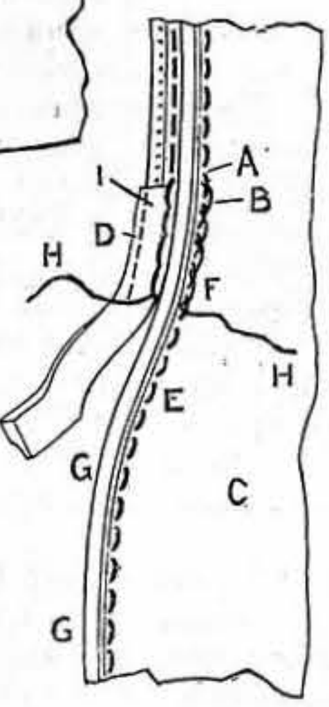

Fig. 3.

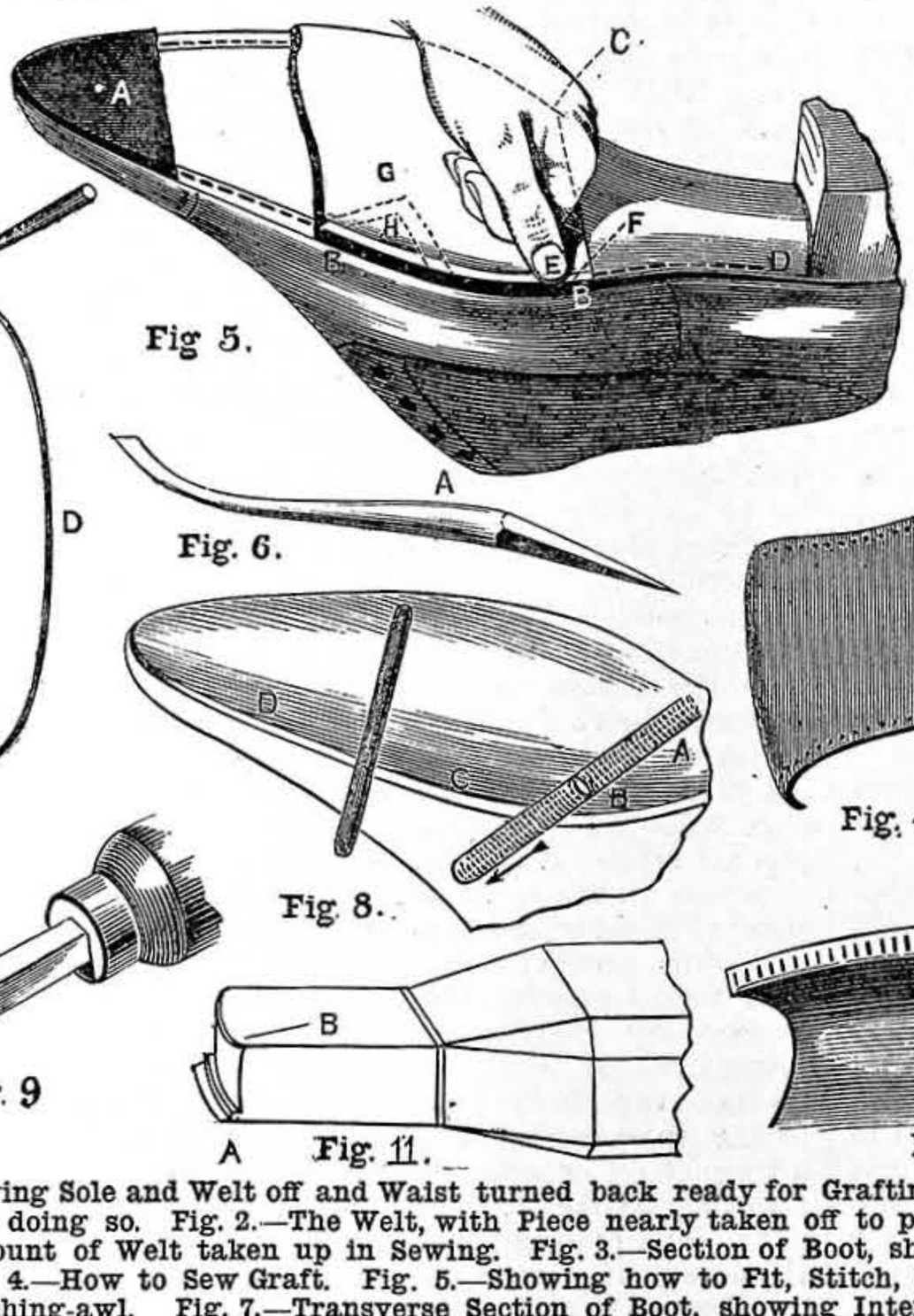

Fig 5.

Fig. 6.

Fig. 8.

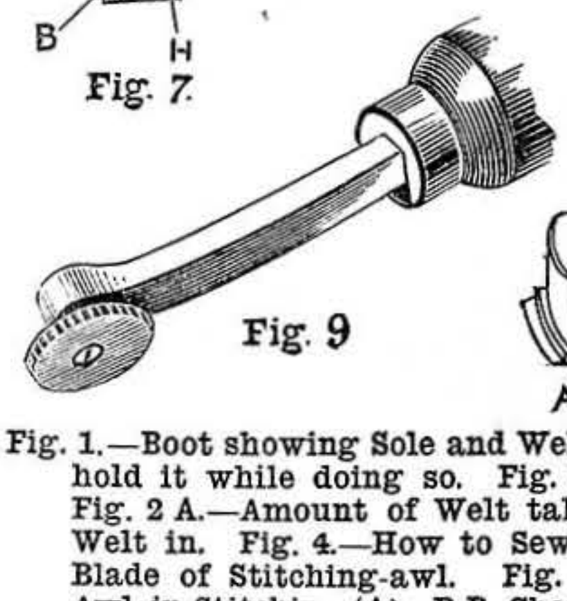
Fig. 9

Fig. 11.

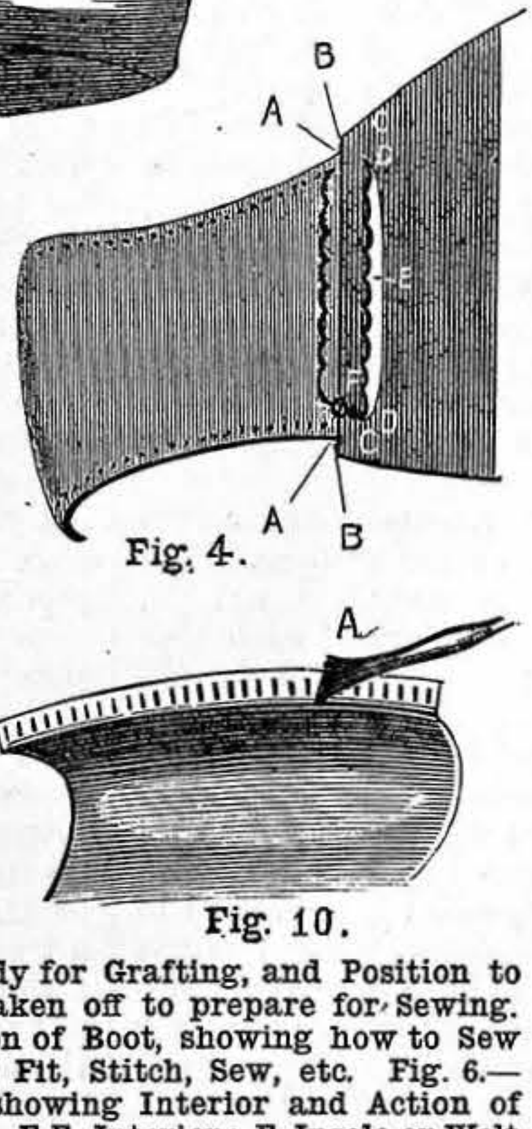

Fig. 4.

Fig. 10.

Fig. 1.—Boot showing Sole and Welt off and Waist turned back ready for Grafting, and Position to hold it while doing so. Fig. 2.—The Welt, with Piece nearly taken off to prepare for Sewing. Fig. 2 A.—Amount of Welt taken up in Sewing. Fig. 3.—Section of Boot, showing how to Sew Welt in. Fig. 4.—How to Sew Graft. Fig. 5.—Showing how to Fit, Stitch, Sew, etc. Fig. 6.—Blade of Stitching-awl. Fig. 7.—Transverse Section of Boot, showing Interior and Action of Awl in Stitching (A); B B, Channel; C, Sole; D, Upper Leathers; E E, Interior; F, Insole or Welt Stitch; H H, Welt; I, Bottom Filling. Fig. 8.—Showing how to rub down Channel. Fig. 9.—Fudge-wheel. Fig. 10.—Section of Boot, showing how to Stitch and Prick them up. Fig. 11.—Double Iron, showing Guards.

If the old bottom filling is good, paste it in again at K, Fig. 1; if not, replace it with new.

Felt is used for this purpose; a pennyworth will fill three or four pairs. In this case cut a piece a little larger than the old, and paste down the shank (generally a piece of skived leather, which reaches from under the heel to the dotted line, L, and just the width of the waist), then paste the new piece of felt in the bottom, hammer it in well all over, and let it dry while you do something else, and when dry skive off the edge all round at M M, making it level with the welt stitch and the centre, K. It is then ready to receive the sole. Prior to placing the sole down, the graft must be made—that is, if you intend to make a sewn graft.

To do this, it is all important to have the old leather cut straight across, and straight through from A to A, Fig. 4, and also the new sole from B to B; then draw a line from C to C about $\frac{3}{8}$ in. wide, and a second one, about $\frac{1}{8}$ in. from the first, reaching from D to D.

From D to D on the first line cut through into the leather about $\frac{1}{16}$ in., holding the knife quite upright; this can then be opened with any blunt instrument to show how far you have cut through. Then from this channel cut one side away to where the second line is (this is towards the toe), holding the knife this time quite slanting; this is to make a recess to receive the stitches, and make a flat seam to the graft, as shown at E.

From D to D make a series of holes (about five to the inch) with a sewing-awl, placing the point flat on the bottom of the recess, and putting it through until its point is just seen in the edge of the leather, about $\frac{1}{16}$ in. from the grain edge.

All this should be done on the flesh side, with the leather fitted in the same way as shown in Vol. III. of WORK, page 113, *et seq.*; with one exception—that is, this being sewn work, the leather has to be used a little more wet.

The boot is now put on the knees, with the toe to the left and the back part on the right knee, in the position shown in Fig. 1, and, as also shown there, with the old waist tied back. The new sole can be put against the old leather, and an old rasp put along on top, as shown at N, and the strap or rope put round the toe of the boot you are wearing, and round the waist of the one you are repairing, as shown at O, and O passing over the rasp, which will, as it presses upon shank, L, the old waist, H, and the new sole, P, keep them all solid while the graft is being sewn.

The graft should be sewn with a good strong thread—say about fifteen strands of No. 9 Patent, or equal to it if a stouter hemp is used—and plenty of wax should be worked into it before it is twisted.

The sewing should be commenced at Q, and continued across to D F, Fig. 4, tying a small but firm knot at F, as each end must be particularly solid, and for this reason it is quite as well to make two short threads, and using one for each graft—it is better than starting and ending with a knot; and another thing is that novices wear out a thread much quicker than an experienced workman does, as it is handled more, and not pulled through without occasional snaps and jerks, and this seam must be solid even at the expense of neatness, which if riveted cannot so well be attained.

It will be seen that the grafting is done on the top of the heel; this is because it is the most convenient place according to the position of the old leather, and also to get a flat surface to work upon—viz., the old top-piece.

If it is found difficult to keep the sole firmly in position by means of the rasp only,

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a long rivet can be put in at H, and another at P. They will only go through into the old lifts, as the heeling should be left till after the soling is done, and the two holes can soon be rubbed out in the finishing.

The graft sewn, the whole of the bottom, K and L, and also the new and old leather, H and P, should have a thin coat of paste. The sole can now be put into its place, pulled over from the toe, and a rivet put through, to keep it in position, as at A, Fig. 5, and one through the hole in the sole that was called P, on the other side of it, in Fig. 1.

This done, hammer it evenly all over, and then pare it up at the edge, close to the welt, the whole way round, as it is shown at B B, Fig. 5. This, as the sole is wet, can, with a little care, be easily done without cutting the upper part, and should be done so as to form one even edge all round, and be kept square or at right angles with the flat of the welt. A line can now be drawn with the compasses all round, about $\frac{1}{16}$ in. from the edge, and upon this line the channel is to be cut to receive the stitch.

To cut the channel the boot has to be held between the knees, with the toe towards you, and a sharp-pointed knife must be held between the thumb and finger, letting the second finger rest upon the top edge of the sole. The knife will then be somewhat in the position of a pen while writing, but it must be held firm, and its exact position with the flat of the welt should form an angle of about 50°. It should cut right through epidermis (the grain) and into the dermis (the fibrous and wear-resisting property) sufficiently to let the thread lay well into it. This will be nearly half-way through the leather, whatever the substance may be, as it is the substance of the sole that will have to decide the thickness the thread will have to be that is to lie in the channel.

The thread being embedded into the firm part of the sole gives not only solidity to the stitch, but leaves the scarf-skin, or grain, free to form a covering for the stitch.

When the channel has been cut, as from B B, and round the toe to C, Fig. 5, it can be opened with any blunt instrument. This is that you may see that the point of the awl comes out in the pit or centre of the channel, and to give the stitch room to fall into it while you are stitching. The grain edge of the channel, G, can be turned over for about two inches. This is to prevent the stitching-awl from notching it, which would make it very irregular and unsightly when finished. When you have set about a dozen stitches, again repeat the process by passing the left-hand thumb-nail along from the last stitch for another two inches.

One of the most essential things to give a good result, and save disappointment, is, in rounding up the sole, not to cut it too close to the welt, more especially on the outside, unless the wearer wears most on the inside, then, of course, the system is reversed.

Prior to stitching the sole on (which is generally done when a boot has been welted) the waist will have to be sewn down with the sewing-awl. It does not matter so much about a channel being cut in the old leather, as the waist can be blacked, which helps to hide the stitch, though if the leather is sufficiently thick to admit of it, it will make a much neater finish.

The sewing is started at D, Fig. 5, and the sewing-awl used till you get to B, the first stitch on the new leather. Then the stitching-awl is used; but, before I go any further, I must tell you that at these two points, B and C, the sewing and stitching should be so arranged that a stitch is set from the old to the now leather, across the graft at B, and from the new to old at C, so as to make these (the weakest points) quite solid.

The stitching-awl is put into the same sort of handle, and is a similar instrument to the sewing-awl, with the exception of it being flat the reverse way, as shown in Fig. 6. In fact, it has now almost taken the name of "the square awl." It will be seen by this figure that when put into the handle it cannot be straight, but has a bow and pitch, at A and B. This makes it more handy to get into awkward places, and gives from pressure on the handle a power that could not otherwise be obtained.

The action and use of this awl are very peculiar—it must not be wriggled about as explained for the sewing-awl, but passed through by one rapid and almost straight jerk.

First, the boot is held on the knees by the strap, toe towards you, on its side, with the sole to the left, and the upper to the right, with the thumb of the left hand pressed firmly against the bottom of the sole, just beyond where the point of the awl is to come out, as shown by E in Fig. 5. The awl is then laid on the upper, with the point against the flat of the welt. It must then be pushed through by one sharp push, just dropping the elbow a little in doing so, sending the point through into the channel that was cut in the new sole, as shown at F, Fig. 5, and also at B B, Fig. 7, the curved motion being indicated by arrow at the top, B.

By looking a little at Fig. 7 a good idea can easily be gained of how a hand-made boot is really put together. It is what a boot would be were you to cut it right through in a transverse direction at the centre of the sole. The key to the various parts will be seen in the description of the diagrams.

The stitching is continued right round, as far as the new leather goes, then the old is sewn as on the other side. Then the channel is again opened, and the stitches that are within it rubbed down well with the bone. Here and there a little paste is put in. This is rubbed in even all round, by putting a piece of rag over the right thumb, and the nail put in the channel, and rubbed up and down all round.

The boot is then held in the left hand, with the heel towards you, and the channel is laid down with an old file, by taking strokes in an outward direction from the centre of the sole, encroaching each time upon the channel in a direction towards the toe, as shown at A B, Fig. 8, which is, of course, continued all round.

The boot is then held in the same position as at first, and a bone or long stick is held with one end in each hand, and the channel is rubbed hard up and down from C to D, and so on until the whole is well rubbed down. Both these actions throw the thin narrow strip of grain (H, Fig. 5) over on to the edge, and it forms a sort of burr all round.

The boot is then held with the toe towards you, and with the back of the knife the edge is scraped in an upward direction to throw this burr on to the top of the sole. The knife is then held flat on to the sole, and the burr cut off level with the top of the sole. The stitches are then rubbed down a little on the welt side with the tapered bone, wetting with the mouth a little every now and then while using it. The bottom is then well and evenly hammered all over.

Before the stitching is commenced (as the stitch is wanted to show up bold on the welt) the fudge-wheel (Fig. 9) should be run round. This will make an impression on it as though it were stitched, and if the awl is put in exactly in the wheel-marks it will do a deal to make the stitch regular.

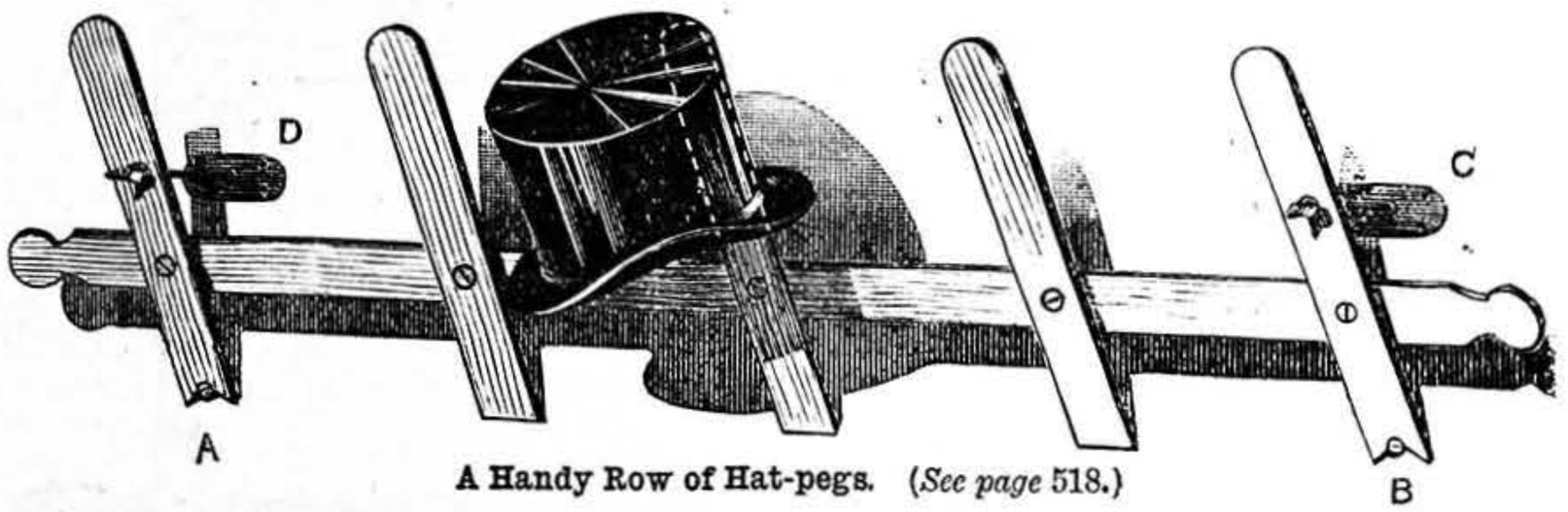
But to get a bold and even stitch this is not all that is necessary, for there is a mode of setting the stitch that is the principal factor in producing this *desideratum*. Each time that the awl is taken out put the left-hand bristle in first, as usual, and in putting in the other one, on the right side, let it pass on top of the other. This will throw up the stitch towards the edge, and if carefully done each time the stitches will form one straight line, as shown by the diagram (Fig. 10). The stitch can be set at, say, 12, 14, 16, or even 18 to the inch, according to work, but 14 will do well for ordinary work, while 18 is seldom necessary for repairs.

After the stitches are rubbed down, the wheel (first warmed) can be carefully run round, letting each cog run between each stitch. This will, in every sense of the word, prick up the stitch, or a prickstitch can be used between each stitch, as shown by A, Fig. 10. The thread should not be twisted much.

The boots are then finished in the same way as described in Vol. III., page 113, *et seq.*, with the exception of ironing up with a double iron, instead of a fore-part iron. A double iron (Fig. 11) is in reality a jigger and fore-part iron combined; the guard A being run on the welt side, and the guard B on the sole side.

For the heeling and other details I must again refer you to the first paper in No. 112, and those that have followed.

And, so saying, I finish my series of six papers on repairs; and six more are in preparation on making, in which I will try my utmost to bring you on—as in these—in progressive form, till you are able to make and repair boots and shoes, not only good enough for yourself, but so that you may at any time, should it be necessary, or to your advantage, be able to take work from others, and recompense yourself in the way that all who try deserve to be recompensed.



A Handy Row of Hat-pegs. (*See page* 518.)

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A HANDY ROW OF HAT-PEGS.

BY J. C. KING.

We all like something we can make in the way of useful household furniture, especially if it can be made without trenching too much on our spare time and spare money; and if it be with some practical advantages we are rather proud of showing it to our friends and expatiating on its merits. During the 1889 Exhibition in Paris, when rents were so high for visitors, the rooms and entries of many of the humbler dwellings were found to be scantily provided with hat-pegs and stick-racks. The S-hooks with knobs were few or absent, which was so much the better for the hat, which somehow so easily comes off that form of hook, or, if it stays, receives a bulge imparted by the knob.

Nailing up a wooden rail for hooks in a French wall leads, in point of fact, to the creation of dilapidations, for which the owner of the apartment does not forget to make you pay on leaving, if the nail does not come away long before, and make you wish you had put your hat on the bed-post or the table. Some friends staying in Paris during the Exhibition found no hat-pegs at their lodging. Something had to be done, and that quickly. The handy man of the family went out, and soon brought back materials: a piece of pine 5 ft. long, 2 in. by 1 in. size, and six pieces 12 in. long, 1¼ in. by ⅝ in.; six screws 1½ in. long, and four screws 3 in. long; and two bits of copper wire 12 in. long. A file, gimlet, hammer, screwdriver, chisel, and sand-paper were part of this young fellow's belongings, so the hat-pegs were made by screwing the short pieces on to the long piece, as shown in sketch; rounding the ends at top and notching the two end pegs at bottom, as shown at A, B, and at the distance of one-third from the top of end pegs boring a hole for the copper wire, which was fastened to two wedges of wood securely fixed in the wall, and a brass screw turned tightly into the wedge, with a leather shield to save the wall from ragging up. Two pieces of copper wire looped under the screw-heads, and held tight against the leather, as shown at C, D, fixed it. The whole concern rested on two screws and hung on two others, with the top ends about six inches from the wall. The whole job only took half an hour, and served for months for hats, coats, and dry umbrellas; and when the lodging was left the room owner gladly gave two francs for it rather than have it unscrewed from its place.

I must not omit that it was admired by visitors so much for its handiness that one of the party gave it a stain, to look like mahogany, of red and black ink mixed—very little of the latter—and some gum to stop the grain; and a coat of spirit varnish made it look like a "fabrique de Paris."

A BOW SAW FOR DEEP CUTTING.

BY OPIFEX.

INTRODUCTION—ADVANTAGE CLAIMED—MATERIALS—CONSTRUCTION — DIMENSIONS — SIDES — CROSS-PIECE—LEVERS—HANDLES—TIGHTENING UP.

Finding the ordinary pattern bow saw to be unsuitable for a special piece of work which required rather deep cutting, I lately made the tool here illustrated, and as it answered its purpose so satisfactorily, I offer the suggestion, hoping it may prove useful to some of the readers of Work.

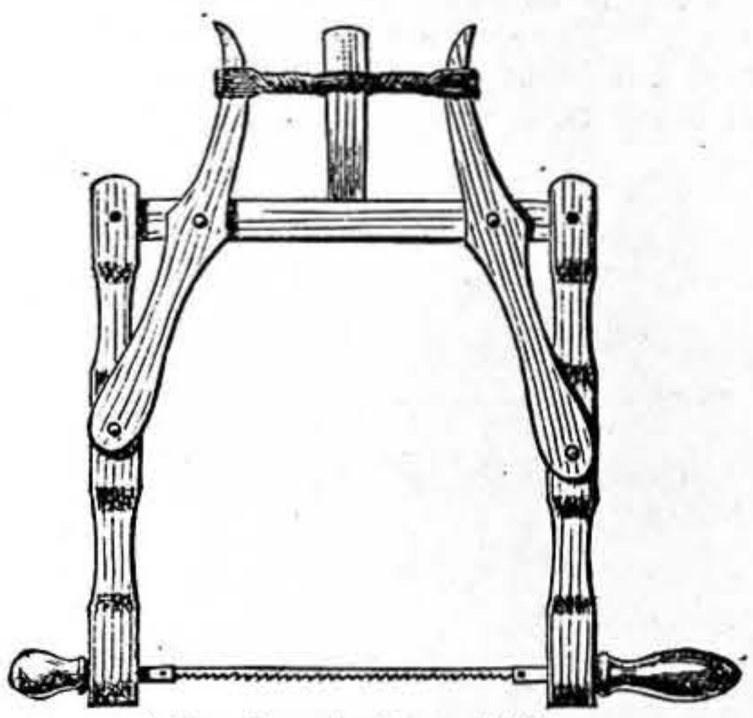
The *advantage claimed* for this saw is that it is twice as far-reaching as one having the cross, or fulcrum piece, placed in the usual position, which is, I think, a point of considerable importance to those who do not possess a band saw, etc.

Materials.—All the woodwork is of good, close-grained beech, which should be well seasoned and free from shakes of any kind. The only other items are four small bolts, 2 in. by $\frac{5}{16}$ in.; four washers to match; two copper rivets, 1 in. by $\frac{3}{16}$ in.; about 36 in. of strong clock gut; and, of course, the handles and saw blade.

The *details of construction* will be easily gathered from the drawing, and I shall not occupy more space than is necessary to describe them very briefly.

The *sides* of the frame are 15 in. by 1¼ in. by $\frac{5}{16}$ in., but these dimensions may be varied proportionally to suit any size of saw—a remark which also applies to all portions of the saw.

The *cross-piece* at top is 15 in. by 1¼ in. by $\frac{5}{16}$ in., and is mortised at each end into



A Bow Saw for Deep Cutting.

the sides, the tenons being held in position by a rivet passing through the centre of each. The shoulders of the mortises should also be slightly rounded and the joints made an *easy* fit, so as to allow of a certain amount of give-and-take movement when tightening up and slackening the saw.

The *lever pieces* may be of ½ in. stuff, and for these the wood should be carefully selected, that the grain may run perfectly straight. They are attached to the sides and cross-piece by the bolts already described, the squares of which should be filed round and the nuts fastened up with washers at the back.

The *saw handles* may be bought at any tool-maker's, etc., for about 1s. 3d. the pair; or they may be easily made, as they consist of two beech handles fitted with brass shanks, having a slit in each to receive the ends of the saw, which is secured in position by a small pin passing through the brass shanks.

The shanks pass through suitable holes—which should be carefully bored with a clean-cutting bit—in the lower ends of the side pieces, as shown in the sketch.

Tightening up.—Holding the upper ends of the levers as tightly as possible with the hand, bind them round with six turns of the clock gut, knot the ends firmly, and insert the "tightener," which may be 6 in. by 1 in. by 1¼ in., and slightly tapered. Give two twists to the gut, and the saw will be found to be sufficiently rigid.

A NOVEL USE FOR PHOTOGRAPHS.

BY ALEXANDER MARTIN.

INTRODUCTION—ADVANTAGES AND DISADVANTAGES—DESCRIPTION AND CONSTRUCTION OF SHELVES—MIRRORS—SECURING PHOTOS—MOUNTS—CANDLE SCONCES—MEDICINE CUPBOARDS—CONCLUSION.

Introduction.—In this novelty-loving age there are constantly being produced all kinds and conditions of things, claimed by their makers as being new and novel. Very often the novelty is of such a nature that after the freshness of the idea has passed away the article loses its only charm, and is thereupon laid aside in the lumber-room or destroyed. One novelty, however, recently seen by the writer, and no doubt by many of our readers as well, is of a more permanent nature, and one, he ventures to think, will have a long lease of life. It consists of using photographs as a means of ornament: little shelves, mirrors, cupboards, etc., for hanging on the wall are decorated with carte-de-visite, cabinet, or other sized photos. These little articles are in great request in every house, as by their means, when of pleasing shape and harmonious colour, little odd spaces of wall may be filled up and made interesting. The photos, again, are an additional attraction in themselves, and increase the interest with which such things would be otherwise regarded.

Pros and Cons.—It may, perhaps, be urged as an objection to this use of photographs that those placed on view will become so well known that they will be disregarded. But they may easily and readily be changed as often as desired; every day fresh faces may meet the eye, and even though not changed often, there is a subtle beauty in a well-executed photograph which will long retain its influence on the beholder.

These articles are particularly pretty when enamelled with any of the delicate shades of Aspinall's enamels; so any wood that is most convenient may be used in making them up—even different woods may be used in the same job without detriment, as all will be coloured alike with the enamel. This is an advantage which will be duly appreciated by many.

Description and Construction of Shelves.—The little bracket shown in Fig. 1 is of very simple construction; its back board is all of one piece of wood, ⅝ in. thick, shaped as shown. The little shelf is placed against this back board, and supported by a shaped bracket underneath. Both shelf and bracket are fastened from behind with screws. The back board is drawn one-eighth full size, so that in making it, each measurement from the drawing in Fig. 1 must be multiplied eight times. The little shelf is 10 in. long by 5 in. broad, and ½ in. thick; and at each of the front corners there is a quarter circle of 2¼ in. in diameter cut out. The bracket underneath is also ½ in. thick, and shaped as shown.

The illustrations, it may be said, will all be found grouped together in a full-page cut. The smaller illustrations are mostly drawn on one-eighth scale, or on a scale of 1½ in. to 1 ft. The diagrams exhibiting working drawings of different parts and modes of construction are drawn full size.

Mirrors.—The mirror shown has bevelled edges; this is the usual kind of glass for such articles, and though costing more money than plain glass, is well worth the extra cost. Bevelled edged glass is so well finished at the edge that ⅛ in. is sufficient "cover" for it—*i.e.*, the opening for the glass should be

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$\frac{1}{16}$ in. all round *less* than the exact size of the glass. The opening in this bracket is $7\frac{3}{4}$ in. by $4\frac{3}{4}$ in., to accommodate a plate 8 in. by 5 in., and it may have a $\frac{5}{8}$ in. bevel. A section of the rebate necessary for the glass is given in Fig. 3, where a blind back is shown sprigged in behind the blocking, keeping the glass in position. Care must be taken that the mitres of the glass bevel fit the corners of the opening as nearly as they can. Strictly speaking, they should fit accurately, but practically it is difficult sometimes to get them right; in that case, they must be "humoured" to make the best of them. If plain glass be used, it is a much more simple matter to put it in, but a full $\frac{1}{4}$ in. all round must be allowed for "cover."

Securing Photos.—The method of fixing the photos in their places so that they may be readily and easily changed is an important one. In the bracket under consideration, three openings might be cut, $3\frac{1}{2}$ in. by 2 in., with a rebate behind each to allow the carte-de-visite to be placed in it. A thin sheet of clear glass in front would, of course, be requisite to protect the face of the photo, and a thin slip of wood, about 1 in. wide and $\frac{1}{8}$ in. thick, might be fitted tightly into the rebate behind the photo. This would keep the carte always in position, and it would not be a difficult matter to remove and change it. But another and a better way is that indicated in Fig. 1, where the three cartes are shown placed in a mount of some sort, which mount is then placed behind a sheet of glass inserted in the large opening, 10 in. by 5 in., prepared for it. The mount is made the same size as the rebate for the glass, into which it therefore fits closely, and behind it is placed a back, $\frac{1}{8}$ in. thick, with two movable cross-bars working on a centre pivot. These bars are made to project $\frac{1}{8}$ in. beyond the edge of the back, so that when the back is placed in the rebate behind the mount containing the photos, these cross-bars enter a little groove made for them in the frame. To facilitate the entrance, the bars are thinner at their extremities, as shown in Fig. 4, which is a section, full-size, of this part of the work. The black portion of this figure represents the glass; the white portion behind, the mount; the hatched portion behind that, the back; and the bar is shown outermost of all. In Fig. 5 is given a sketch of the back, showing the two cross-bars in the position they must assume to get it out and into its place. This is exactly the arrangement of movable back which is found in the common drawing-slate known to us all as children.

Mounts.—The "mount" containing the three photos must here get a few words to itself. It may be of cardboard, wood, silk, or other material. A cardboard mount is, perhaps, most easily made: a sheet of cardboard is made the exact size of the rebate, and has three openings cleanly cut in it to show the three cartes. This card may then be made like the leaf of a photographic album by means of other cardboard strips, covered with a sheet of stout paper all behind, which paper is cut to admit the carte being pushed up into its position—just as in an album. Or a simpler fashion is to glue a strip of cardboard of about the same thickness as the photo is round the exact position the photo is to assume, in order to keep it in its place. The back then put on behind it will keep it firm and fast. This mount may be made of wood—oak, mahogany, walnut, beech, chestnut, or any other wood—and left its natural colour, as when protected by the glass there is no danger of its becoming soiled. Little slips of thin wood must be fastened on behind this mount, as in the cardboard mount, to keep the cartes in position. Another way of finishing the mount is to cover it—either the cardboard or the wood one—with silk or plush of a delicate shade. A nice pale azure-blue or a pretty salmon colour would contrast nicely with the photographs, and with a white or a cream-coloured enamel on the woodwork. This must be left, however, to individual taste, as what would please one might not please another. Two little brass plates are shown on the top edge of Fig. 1; these are to fasten the shelf to the wall, and are screwed on at the back of the back board.

Candle Sconces.—The article sketched in Fig. 2 is of a different kind; it has no shelf, but has a pair of candle sconces attached. These may be had at various prices, from about 3s. per pair upwards, and they form a very great attraction both by day-light and by candle-light. The mirror between them catches and reflects their light, and the photos above could not be in a better position for being seen to advantage. This figure is also drawn one-eighth full size, and is made out of one piece of wood. A suggestion might be made as to placing a cabinet photograph where the mirror is, making the opening to suit; but unless specially desired to be so made, the mirror ought to have the preference.

Another arrangement is given in Fig. 6, where a cabinet photograph is placed on each side of a mirror, and a shelf is attached. This might be made with the back board, $\frac{5}{8}$ in. thick, all in one piece, but it would be better to form it with top and bottom rails half-checked into the side rails, and the centre divisions half-checked into top and bottom rails, and placed into them from behind. Before half checking them, the rebates round all the openings should be run. The shelf, 19 in. long by 5 in. broad, and $\frac{1}{2}$ in. thick, is supported on two brackets, also $\frac{1}{2}$ in. thick. The glass and photos are placed in position, as already described in connection with the first of these articles (Fig. 1). This also is drawn one-eighth full size.

A shelf with accommodation for five carte-de-visites is shown in Fig. 7, to the same scale as before. This is, however, shown of different construction; two posts, $1\frac{1}{8}$ in. square, with turned knobs at their lower ends, have a rail at top and bottom mortised into them, and underneath the bottom rail is placed a shaped piece of wood $\frac{1}{2}$ in. thick. The posts and rails are rebated to receive mount, glass, and back board as before. Above is placed a shelf $4\frac{1}{2}$ in. wide, which is supported with two brackets placed on the face of the posts. Both these and the shelf are $\frac{1}{2}$ in. thick, as well as the back ledge put on above all. The wall-plates should, for sake of strength, be placed, in this instance, on the posts underneath the shelf.

A more elaborate shelf is given in Fig. 8. It is framed together in the same manner as that last described, and is drawn to the same scale. Two cabinet photos are shown above the glass, which is dome shaped on top. The shelf, $\frac{1}{2}$ in. thick, is 4 in. wide at each end, curving out to 6 in. wide in the centre. A row of turned spindles under the shelf adds considerably to the general effect. A full-sized section of the post, showing it beaded and checked, or rebated, for the glass, etc., is given in Fig. 9.

Another simple little shelf, formed in the same manner as those just mentioned, is sketched in Fig. 10, while in the next figure is shown a larger one. This has a double shelf above the two cabinet photos shown, and is surmounted with a balustrade. The two posts enclosing the portraits are carried up to the topmost shelf, which should be checked to allow them to reach the top of the shelf. The wall-plates should be fastened to the tops of these posts. The four turned pillars at the corners of the shelves keep them equally apart, while the brackets underneath sustain them under any weight they may be called on to bear. The shelves are 21 in. long by 6 in. broad, and are $9\frac{1}{2}$ in. apart. The posts are 1 in. square, and rails $\frac{3}{4}$ in. broad and 1 in. thick. The turned pillars are 1 in. thick, and the spindles are $\frac{5}{8}$ in. at their thickest part, and 2 in. long over the shoulders, the pins at each end for fixing to shelf and spindle rail being beyond.

Medicine Cupboards.—A handy little medicine cupboard is shown in Fig. 12, drawn nearly one-eighth full size. The gables are 6 in. wide. As, however, the doors should be made to suit the size of photo used, they shall first receive our attention. A moulded rail is formed as in Figs. 14, 15, or 16, these being all alternatives for the same purpose, and are drawn full size for the sake of clearness. This rail is mitred together exactly like a picture-frame, and has the glass, mount, and movable back put in as before described. The gables are held together by the top and bottom of cupboard being dovetail-raggled into them, as shown in Fig. 17, also drawn full size, showing the gables and shelves to be $\frac{5}{8}$ in. thick. A shelf 4 in. broad should also be raggled into the gables, about half-way between the top and bottom of cupboard. A shaped spandrel is fixed under front edge of cupboard, while the back ledge at top and bottom is also shaped as seen in Fig. 12. This back is $\frac{3}{8}$ in. thick, and is set into the gables as shown in section in Fig. 18. The doors must have something to stop against when closing. A little stop is inserted in top and bottom of cupboard inside the doors, so that they may close against something solid. A sketch of this stop is given in Fig. 19, full size; in this sketch the dotted line shows the extent the stop is inserted into the wood, and it should be so placed that both doors will get the benefit—*i.e.*, immediately behind where the two doors meet. A little slip-bolt will be required on the left-hand door, and a lock on the right-hand one.

The remaining illustration (Fig. 13) shows another arrangement of a medicine cupboard. It has only one door, however, and at each side is a corner shelf for the accommodation of a vase or other article of vertu. The construction of this cupboard is very much similar to the former one, with the addition of the side brackets and shelf. Another plan would be to frame the back with the side shapings, and top and bottom rails, with a panel grooved into them, and the gables top and bottom of cupboard placed against this back. The door, of course, is formed in the same manner as the others, any of the sections given in Figs. 14, 15, and 16 being alike suitable.

Conclusion.—Amongst the many ingenious arrangements that have been made for keeping and displaying photographs, this idea of utilising them as decoration for useful articles, differing so much from the usual methods of storing our friends' counterfeits, will probably long retain its hold on the public taste. It is, of course, impossible to sketch all—or anything like all—the different forms and combinations which may be assumed; those given must suffice, leaving the ingenious reader to follow up—if he will—the lines placed before him in these pages.

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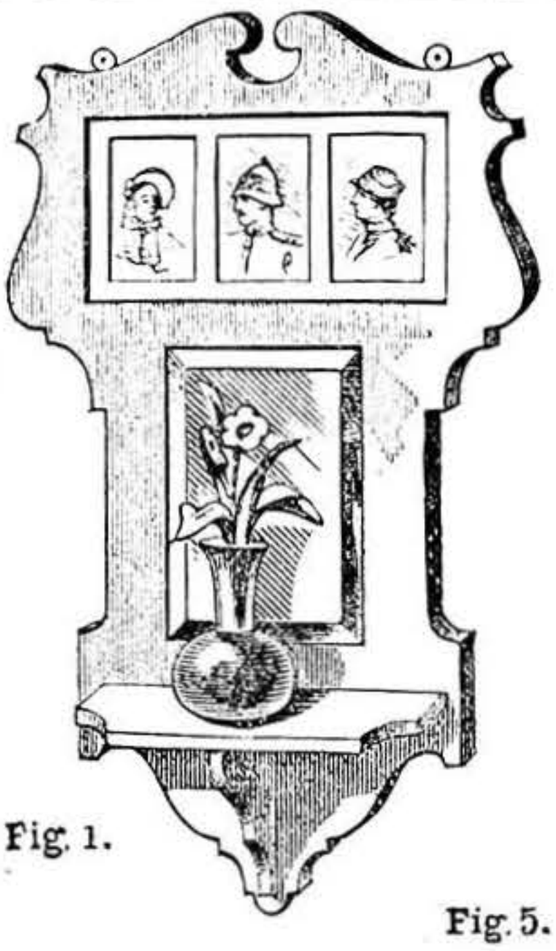
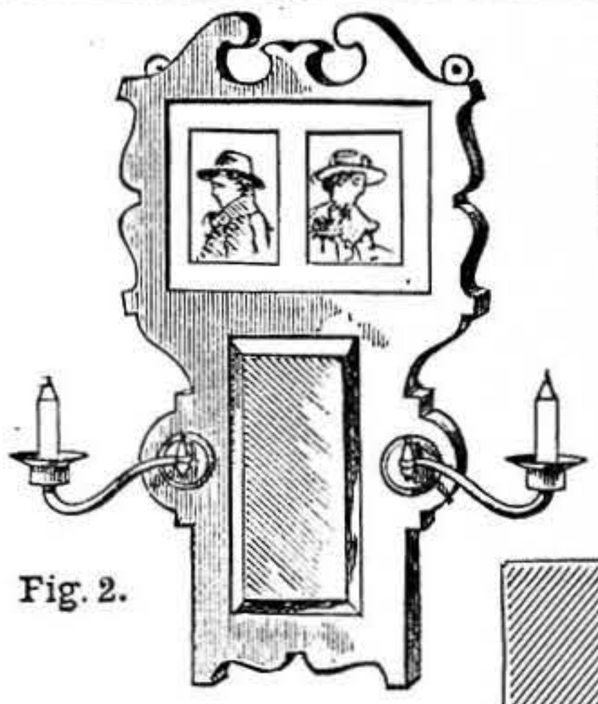


Fig. 1.



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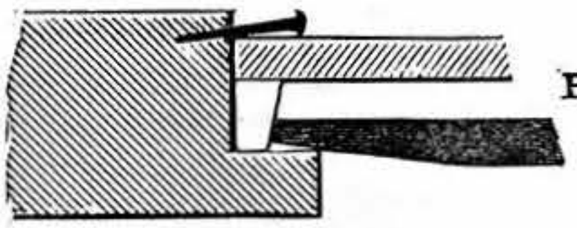

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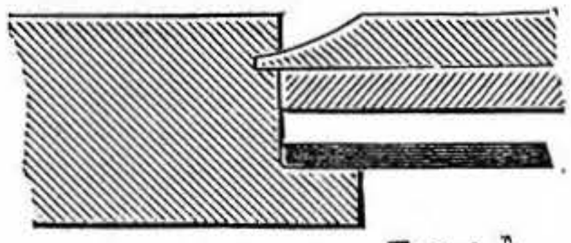
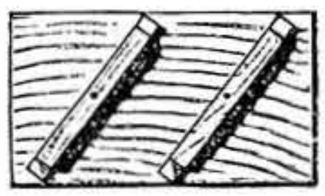


Fig. 4.



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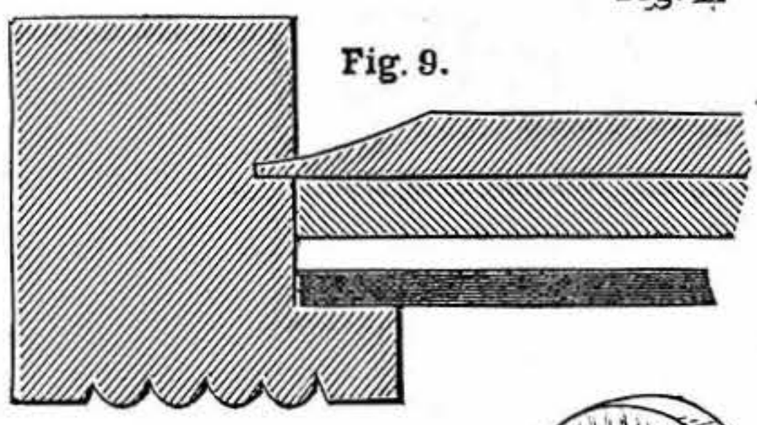

Fig. 9.

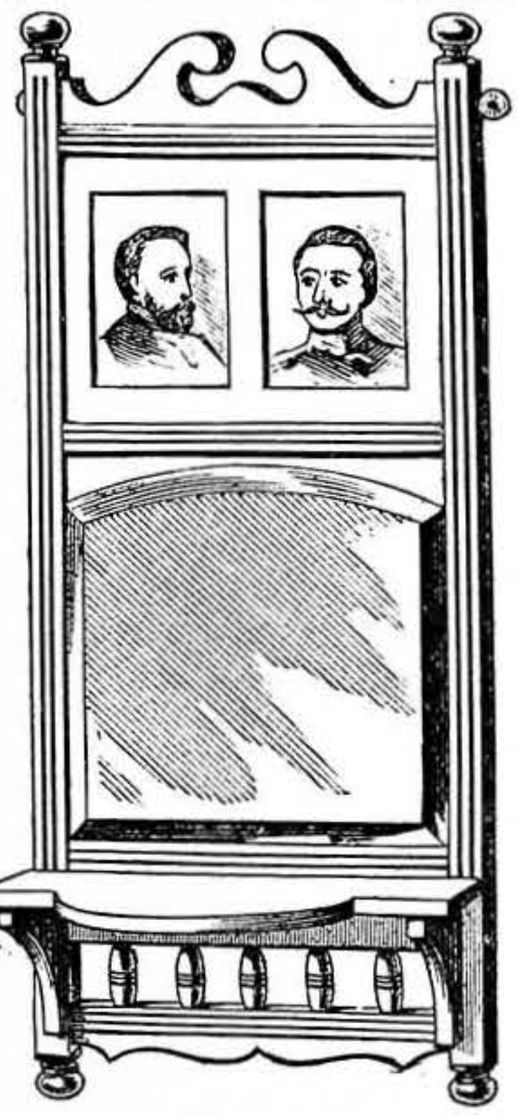

Fig. 8.

Fig. 19.

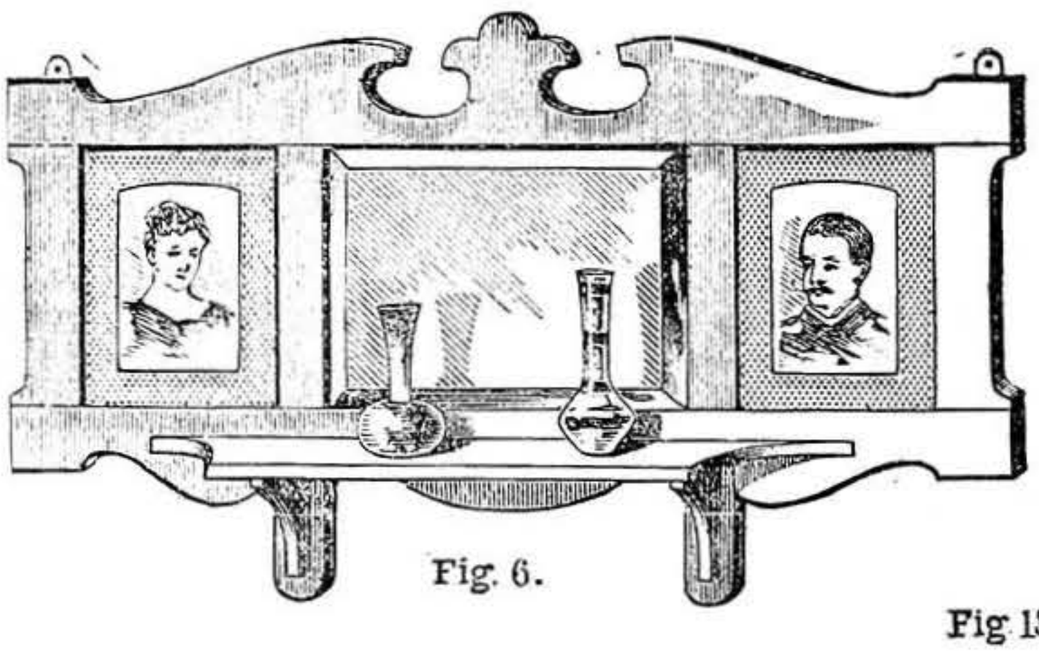

Fig. 6.

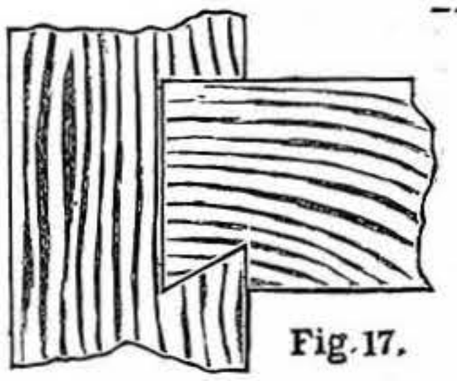

Fig. 17.

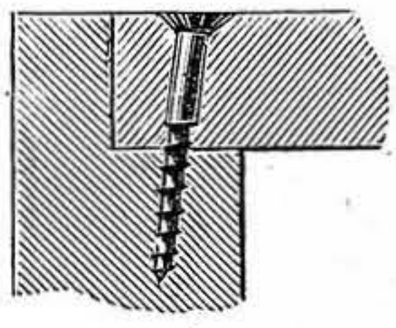

Fig. 18.

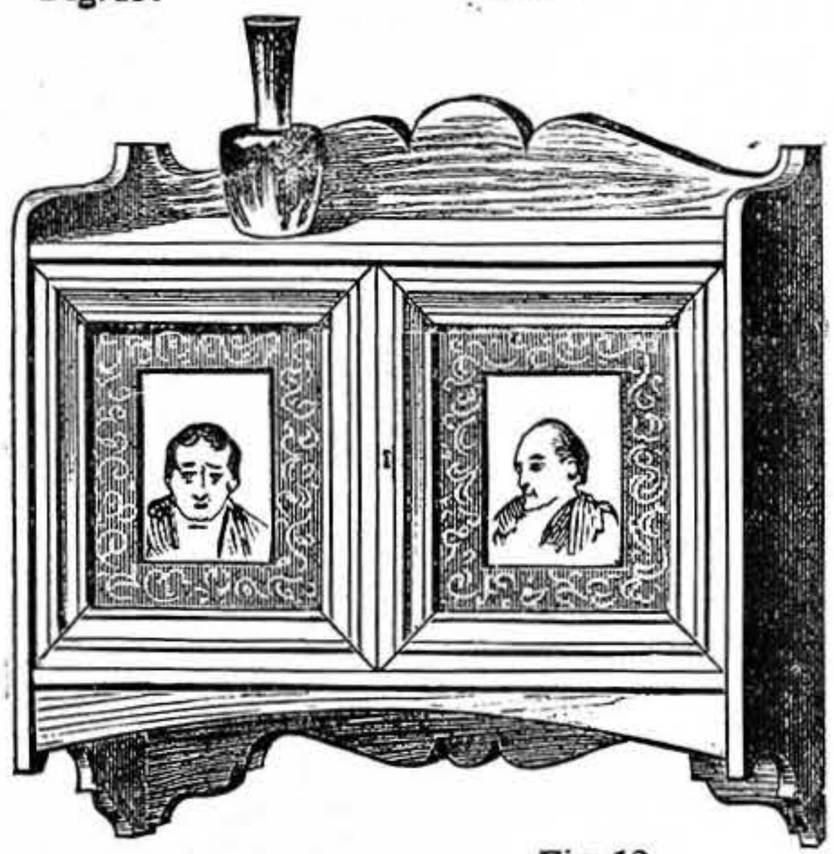

Fig. 12.

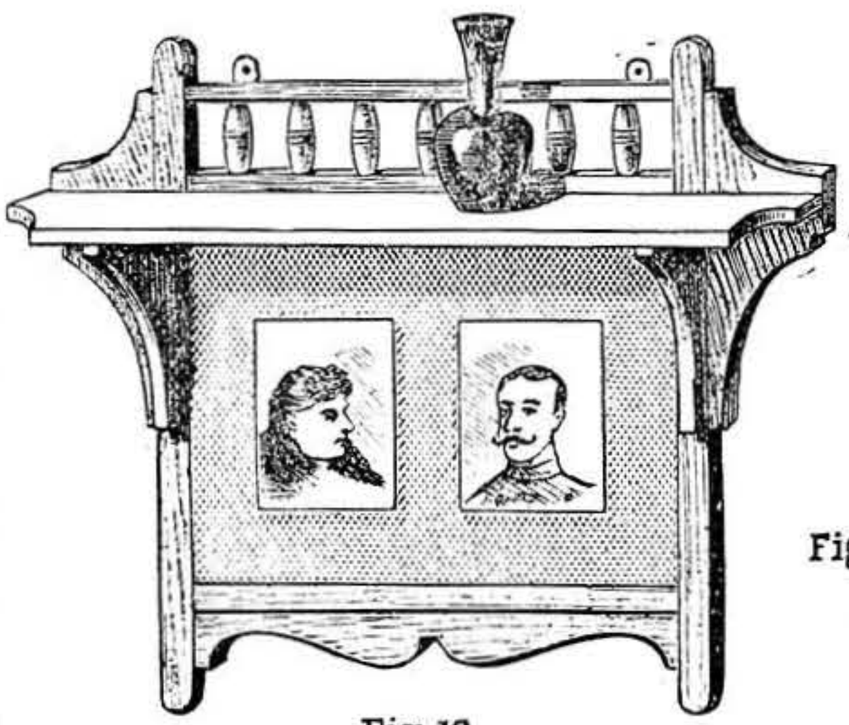

Fig. 10.

Fig 15.

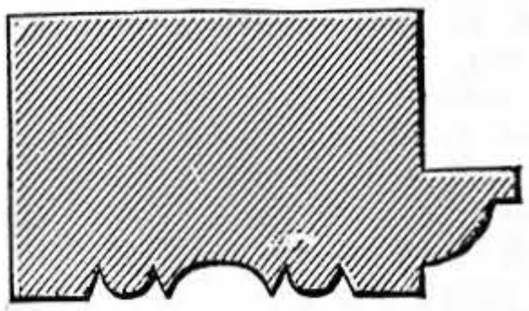

Fig 16.

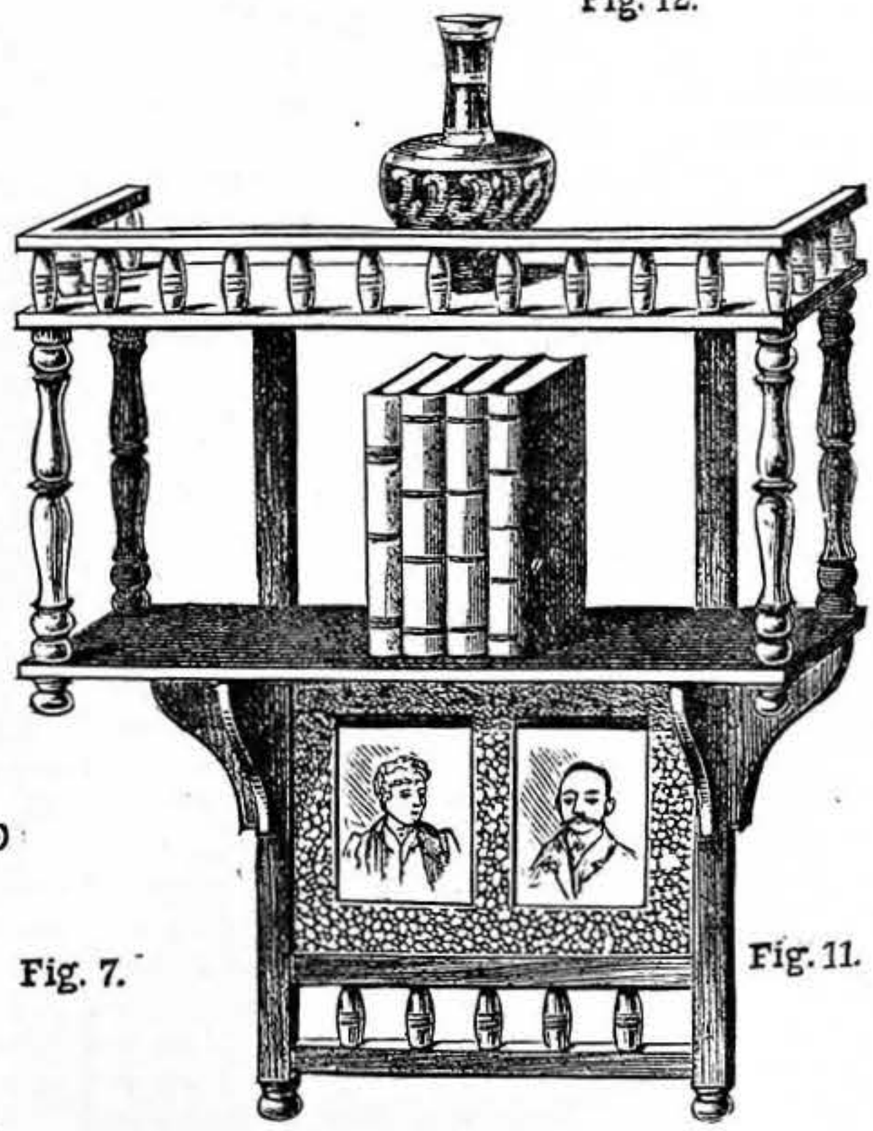

Fig. 11.

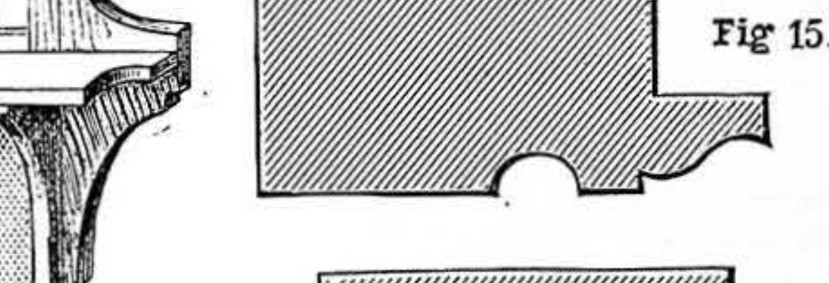

Fig. 14.

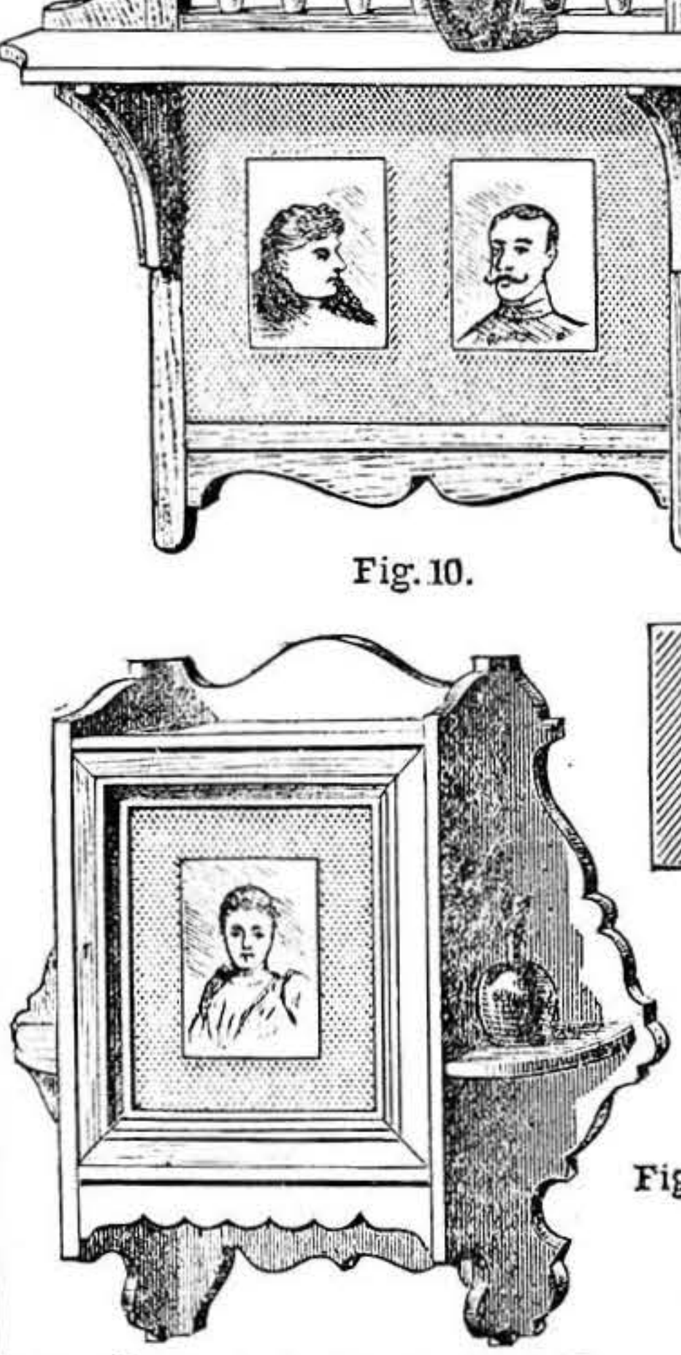

Fig. 13.

Fig. 7.

Fig. 1.—Bracket. Fig. 2.—Photo Frame with Mirror and Sconces. Fig. 3.—Rebate for Glass. Fig. 4.—Groove for Cross-bars of Back. Fig. 5.—Back with Cross-bars. Figs. 6, 8, 10.—Brackets with Shelf, Mirror, and Photos. Fig. 7.—Bracket for Five Photos. Fig. 9.—Section of Upright in Fig. 8. Fig. 11.—Small Bookshelf with Top Shelf for Bric-à-brac. Figs. 12, 13.—Medicine Cupboards. Figs. 14, 15, 16.—Alternative Mouldings for Rails. Figs. 17, 18.—Details of Jointing. Fig. 19.—Stop for Door.

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THE SAFETY BICYCLE: ITS PRACTICAL CONSTRUCTION, ETC.

BY A. S. P.

ENAMELLING, ENAMELLING STOVE—NICKEL-PLATED PARTS—RUBBER TIRES, CEMENT, METHOD OF FIXING—WIRED TIRES REQUIRING NO CEMENT—SPLICING TIRES—FITTING MACHINE TOGETHER AND TESTING BEFORE ENAMELLING—RE-FITTING UP—ACCESSORIES.

HAVING got our wheels and frame ready for the enameller and plater, the remaining work after these processes have been gone through is the fixing on the rubber tires and the fitting of the machine together. As to enamelling, the machine may be enamelled by baking in a stove, or it may be enamelled with a brush; the former is, however, by a long way the best: indeed, all good work is stove-enamelled. But for the mechanic making his own machine, the fitting up or providing of an enamelling stove is out of the question. It is a concern that costs £9 or £10, so if his machine is to be made a good job it must be sent out to a practical enameller, who will do it at from 15s. to 20s.; lining, if wanted, a few shillings extra. If it is to be done in the stove, it must be done before the tires are put on the wheels; if with a brush, the tires may be on or not, at option. For an enamel, or japan, to put on with a brush, I would recommend the Club hard-drying black enamel, which is sold by the Silico Enamel Co., and at most cycle shops. It is the best I have tried, and dries in a few minutes; for this reason it is somewhat difficult to apply, one part being dry before another is coated. It should be put on with a brush about an inch broad, covering a good bit of surface with a stroke of the brush. Two coats will be required on all parts that have been polished bright, so the whole may have two coats with advantage. It is to be understood, however, that this brushing process will not give results at all to equal stove work. It is only a substitute for the real thing, and is only used by makers on a cheap trashy class of machines. All the parts to be plated are, of course, removed from the frame before enamelling.

The plated parts of our machine comprise the following (although it is a matter of choice which to plate and which to enamel): handle-bar with its extension tube, brake-lever with the brake-rod (B, Fig. 35), lamp-bracket (Fig. 33), cone collar (Fig. 38), L seat-pin (Fig. 30), the wheel hubs before wheels are built, cranks, pedals, bottom ball-bearings, pedal shaft, brake-spoon pin (Fig. 34), adjusting screws (Fig. 40), and all bolts and nuts about the machine. For Figs., see page 436.

We now give our attention to the tires, which are attached to the wheels after they have undergone the enamelling process. Our wheels are 30 in. by $\frac{3}{4}$ in. ordinary crescent; we therefore require two tires of these sizes, and I should here advise the procuring good rubber, somewhat about 4s. 6d. or 5s. per pound, as such tires are cheapest in the long run. The rubber may be either red or grey, so long as it is of good quality. Our tires are fixed on the rims with a cement made for the purpose, and sold at 1s. and upwards per pound, according to quality. Having thoroughly cleaned the rim, place the tire on it without the cement, in order to see if it requires stretching; because if it requires stretching it must be pulled equally all round the wheel, else you will have thick parts and thin parts, making a lumpy wheel.

Having melted the cement over a fire or a gas-jet, using an iron ladle with a spout for pouring (Fig. 43), have the wheel mounted on a spindle caught in the vice or driven into a post, then with a red-hot $\frac{5}{8}$ in. iron rod heat up the rim all round by revolving the wheel; this done, pour the cement from the ladle, which, if properly melted, will be as thin as hot glue, and will run freely in an even stream all round the wheel, the ladle being held stationary and the wheel turned slowly with the left hand. Now place the tire in position before the cement is allowed to cool, and give it the necessary stretching, if any, taking care to place it in the rim without twist. There is generally a little ridge on the extreme top of the rubber tire, left there in the process of moulding: this ridge forms a good guide for placing the tire evenly in the rim. We now requisition a tire heater (Fig. 41): in this case a gas tire heater. The curved top piece of this instrument is perforated, and emits a number of gas-jets, the gas being led up through the shank from the rubber tube, said tube being attached to an ordinary gas-bracket with the burner removed. These heaters are made with the jet-tube from three or four inches up to nine or ten inches long; five or six inches is quite long enough. The rim is heated on the under side at the spokes with this instrument, the rubber tire being worked gently sideways with the fingers; the heater re-dissolves the cement in the rim, and when that takes place the tire rolls freely and the cement oozes out at the edges of the rim. This is continued all round the wheel, about ten minutes being sufficient for the purpose. See that the rubber is without lumpiness when setting it in the re-dissolved cement, as any flat parts can be easily remedied by pressing the tire from both sides towards it while the cement is hot. If too much cement has been put into the rim from the ladle, it will ooze out too much and smear both rim and rubber tire, making the latter (as it will not come off clean) very unsightly; there should only be as much cement in the rim as will make the rubber float when it is re-heated. If a tire is put on in the way I have described above it is sure to stay on, assuming that the cement is good. All that is required in fixing a tire is to make a proper union between the steel rim and the cement and between the latter and the rubber; the cement, if of a good quality, has the property of adhering to both these substances, iron and rubber, with great tenacity. The part the workman plays is to complete the union in a proper manner between them.

I have handled a lot of wheels made by a well-known firm, in which their method of enamelling is to dip the wheel, minus the tire, in a vat of stoving enamel, then to bake it in the stove. The result of this is that the hollow rim that is to receive the tire is enamelled the same as the other parts of the wheel, and on this enamelled surface the cement does not hold as on the clean metal. Their method of putting on the tire seems to be to heat up the rim, pour a light stream of thin cement, and to place the tire on, pressing it all round, and dispensing with the re-heating process, the result being that only a partial adhesion has taken place, the cement cooling too quickly to allow of a proper union with the tire, and which only re-heating will effect properly. I have had wheels treated in this way for tire fixing, where not a particle of the cement had found adhesion with the rubber; you could push the rubber out of the rim with the thumb without difficulty, and when removed half round the wheel the remainder would peel off by its own weight, and this on a machine costing about £18.

I would advise, therefore, a careful re-heating, with the jets not too large, in case of damaging the enamelled rim; or if the wheels are to be done with the brush, I would advise that the rubber tires be fixed in their places before painting.

It may be mentioned that there are tires in the market that require no cement; they are fixed in the rim by a wire passing through their centre as a core; it is pulled by screwing at the wire ends which are fastened to the rim. I have not seen them, so cannot speak of their advantages, or otherwise, from experience. There are tires also that require no cement, on account of the formation of the rim, but of these I need not speak further. I believe the best thing yet is the good old method of fixing by cement, and where it fails of its purpose it is the inevitable result of defective workmanship.

One method of making rubber tires is to mould them in long, straight lengths, then to make them to fit size of wheel by splicing. This splice sometimes gives way and has got to be repaired. A good solution for

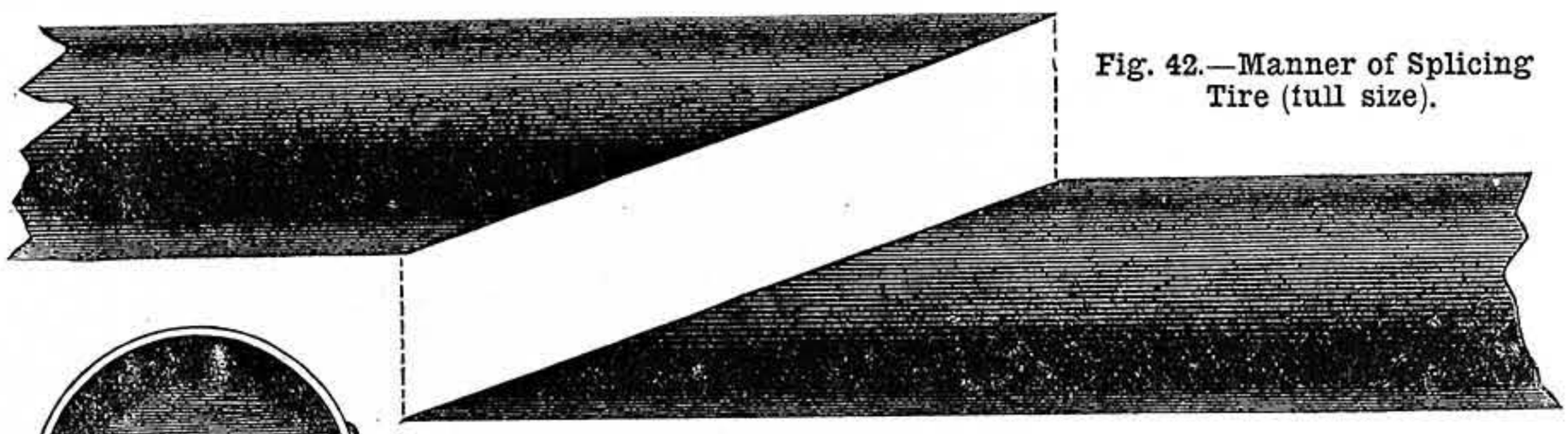

Fig. 42.—Manner of Splicing Tire (full size).

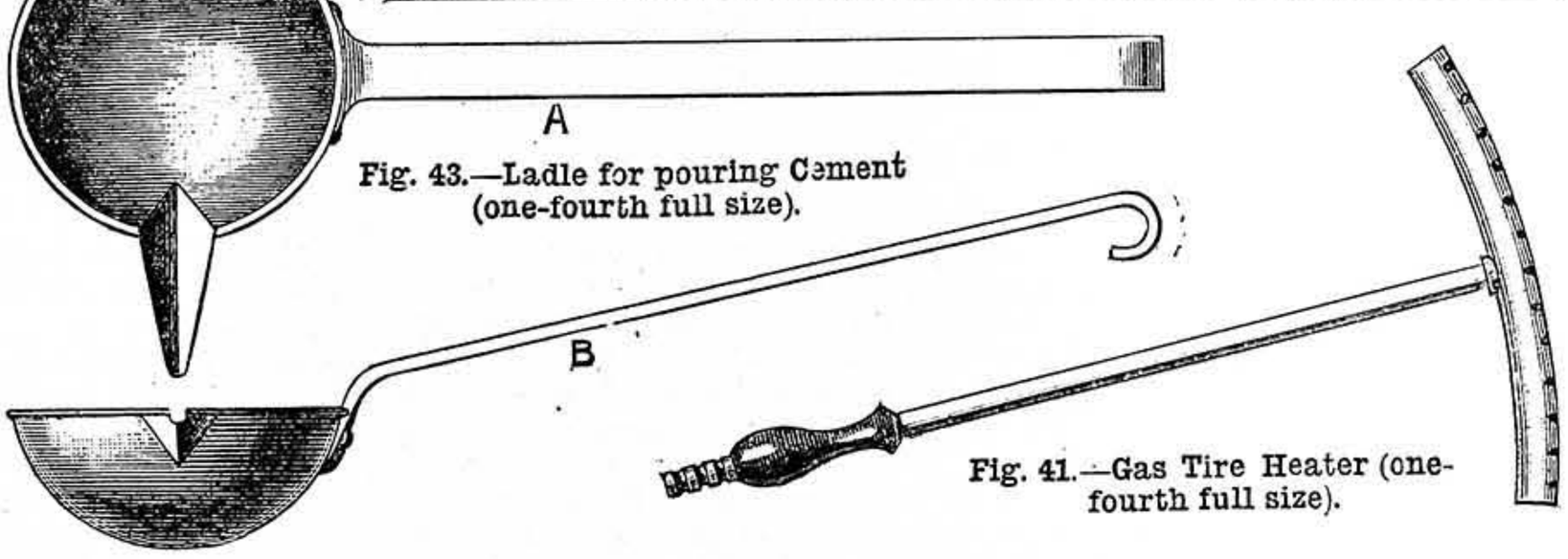

Fig. 43.—Ladle for pouring Cement (one-fourth full size).

Fig. 41.—Gas Tire Heater (one-fourth full size).

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this purpose is sold in most of the cycle shops.

A tire too large for a wheel, or a tire to be adapted to a smaller wheel, has to be cut and re-joined. It is done by splicing in the same way. The method of doing this is shown in Fig. 42. A clean cut with a sharp thin knife dipped in water is made slanting as shown, the cut being about two inches long; this cut is made on both ends of the rubber, and both from the upper or outer side of the rubber, so that one side of the splice will lie embedded in the cement. Both cuts must be exactly the same length, and made straight and smooth; these cuts are smeared with the solution above referred to, and the tire laid aside *before joining* for an hour or more; after that time the two splays are laid carefully together and pressed with the fingers; they may then be beaten with a bit of wood, when the joint will be found to adhere so that you could not pull it asunder, and you may proceed at once to fit it on the rim, and to use it on the road immediately.

The solution referred to is sold in one shilling bottles. Accidental cuts in tires may be repaired with it by cleaning out the parts carefully and smearing them with the solution, after which they may be kept open for an hour or so, when they may be pressed close, and the wheel is then ready for use without further waiting.

After the tires have been set in the rims and put aside for an hour or two, all superfluous cement must be cleaned off; it will come much more readily off an enamelled surface than off the rubber; allowing it to get on to the rubber should therefore be avoided as much as possible.

Now I will assume that you have got your frame and wheels done nicely in an enamelling stove, and the other parts enumerated in this chapter well plated, and that you have put on the tires as above directed. What remains now is to fit the whole together to complete the job. Having had the whole job fitted up complete before it went out to the enameller, you will have no difficulty in the re-fitting. At this point I would impress upon anyone making his own cycle the necessity of fitting up his machine complete, every item in its place, and testing the whole before it goes out to enamel; he should see that his two wheels are running in line with each other, so that when running straight they will make but one track; he should see that all moving parts move freely, such as brake and handle-bar adjustment, seat-pin adjustment, etc. etc., that all set-screws and bolts are performing their work effectually, that no nuts are made too easy in the threads, and therefore liable to drop off; he should also mark all parts that go in pairs, so that he will know how to replace them at the final fitting up: such, for instance, as the ball-bearings in the bottom brackets, cranks, pedals, etc. He should lift his rear wheel off the ground and drive it at great speed, to see that the chain runs freely, does not threaten to come off, and does not make any undue noise. Then, if he has facilities, he should further test his machine by getting on to it, or getting a rider on to it, and running in circles and figure 8 on a floor or a smooth clean court, so as not to damage the tires. This operation will discover any cracks, flaws, or other defects, which should by all means be cured before going to be enamelled. If it passes through this ordeal without sign of failure in any part, then the maker may congratulate himself on having done a creditable bit of work.

I will assume that the cycle builder has done all this, and that the enameller and plater have satisfied him with their part of the work, and that he has everything ready to re-fit up: this, I assure him, will be the most agreeable part of the whole task. But as this paper is about long enough, I will leave him till my next and concluding paper of this series, in which I will assist him in this pleasing operation, and show, by illustration, his machine completed and fully equipped for the road, and which I hope will be to him a thing of beauty, and if not a joy for ever, at least for a long time to come.

The accessories not mentioned in these papers, and that are necessary to equip the machine, are lamp, bell or horn, tool-bag, spanner, and oil-can. These I will notice shortly in my next, which will conclude with a few hints to the mechanical cyclist how to take care of his machine: such hints being intended for the benefit of cycle owners and users generally, and apart from own cycle builder, and which, it is hoped, will be duly appreciated by them.

OUR GUIDE TO GOOD THINGS.

*** *Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of anyone who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.*

78.—The City Polytechnic.

Having called attention in the last number of Work to the classes for the study of wood carving at King's College by the united action of the Carpenters' Company and the authorities of King's College, I must do the same in behalf of the City of London College, White Street, Moorfields, E.C., otherwise known as the City Polytechnic, in union with the Society of Arts, the Government Department of Science and Art, and the City and Guilds of London Technical Institute, whose forty-fourth annual session for 1891-92 is now in progress. Lectures and lessons are given in technical drawing and drawing office practice, building construction, machine construction, civil and mechanical engineering, quantity surveying and land surveying. Application for further information with reference to terms, fees, etc., should be made to Mr. David Savage, the Secretary, at the College. The principal lecturer is Mr. Henry Adams, M.Inst.C.E., M.I.Mech.E., F.S.I., etc., assisted by Mr. A. B. Hoskin, science teacher.

79.—Goldsmiths' and Jewellers' Trade Classes.

A contributor to Work, Mr. H. S. Goldsmith, who has taken up and successfully dealt with two branches of goldsmiths' work in his papers on Brooches and Earrings, calls attention to the fact that, for the first time in London, a course of lectures, amounting to about thirty in number, on goldsmiths' work and the manufacture of personal ornaments will be given by Mr. Harry Stapleton on Friday evenings from 8.30 to 9.30 p.m. at the Polytechnic Young Men's Christian Institute, Regent Street, W. Only those who are engaged in the goldsmith or jewellery trades will be eligible to attend the lectures. The classes, I believe, will have started before this number of Work appears. It may be useful to add that the instruction afforded will embrace the following: (1) The principles and methods of manufacturing the various kinds and styles of personal jewellery; the exhibition and description of the tools generally used; the simpler gold alloys and their solders, together with the various methods adopted in finishing gold work. (2) Special lectures will also be given dealing with the subjects of chasing, engraving, and enamelling: special classes being also held for designing and chasing, as applied to goldsmiths' and jewellers' work. (3) Other information than that which may come under the foregoing heads, likely to be of special advantage to all engaged in the various branches of the trade, will also be included.

80.—"Cyclist and Pedestrian Guide to the Neighbourhood of Dublin."

This guide, which has been prepared and produced by a cyclist well known on both sides of St. George's Channel as one who can hold his own when in thorough condition, both for long and short distances, against all comers—Mr. R. J. Mecredy—appears to be a model book for the purpose for which it is intended, and might well be imitated in the production of similar volumes for various parts of England and Wales and Scotland. The plan of the book is simple but useful. Descriptive matter relative to any particular place, and the means of reaching it, are given in the centre of the page, and then, as marginal notes on the left hand, are the successive distances from one place to another mentioned in the route until the destination is reached, and on the right hand the condition of the roads. First of all, all the various exits from Dublin are dealt with, with some noteworthy runs. Then follow straight-away and circular rides from the General Post Office, Dublin. The book is well illustrated by cuts, and is rendered still more complete by an excellent index, in four columns, of which the first contains the name of the place; the second, the direct route; the third, reference to page; and the fourth, the distance in miles and yards. No cyclist resident in Dublin, or visiting Dublin, should be without this exhaustive and well-arranged volume.

81.—Pictorial Astronomy for General Readers.

Messrs. Whittaker & Co. have added to their Library of Popular Science a volume entitled "Pictorial Astronomy for General Readers," by George F. Chambers, F.R.A.S., of the Inner Temple, barrister-at-law, the author of various legal and scientific works, among which is the "Handbook of Descriptive and Practical Astronomy," produced at the Clarendon Press, Oxford, in three volumes. Of course, the volume now under consideration is an inexpensive book of moderate compass, and is based, to a limited extent, on Hinds' "Illustrated London Astronomy," which appeared some forty years ago, but is now out of print, and whose illustrations have consequently been utilised for Mr. Chambers' book. The mode of treatment will perhaps be best understood from a short summary of the subjects of the successive chapters, and which, after the preliminary introduction in explanation of the various branches of the subject which are embraced under the general term "Astronomy," deal with the solar system, the sun, the inferior planets, the earth and the various phenomena connected therewith, the moon, the superior planets, eclipses, transits, and occultations, comets, meteors, the stars, clusters and nebulæ, telescopes, the spectroscope, the history of astronomy, the utility of astronomy, tables of the planets and satellites, and a catalogue of celestial objects. A sufficient index completes a book that is well and succinctly written, and being in simple language, is as well calculated for the use of the young as those of riper age.

82.—Finsbury School of Practical Amateur Mechanics.

I am requested to state that the classes for Cabinet Work and Carpentry, Wood Carving and Engraving, Wood Turning, Metal Working, and Mechanical Drawing, carried on under the superintendence of the Principal, are now in active operation.

The Editor.

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SHOP:

A Corner for Those who Want to Talk It.

*** *In consequence of the great pressure upon the "Shop" columns of* WORK, *contributors are requested to be brief and concise in all future questions and replies.*

In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of WORK *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

I.—Letters from Correspondents.

Answers by Post.—Correspondents generally are requested to bear in mind that no letters with reference to subjects treated in "Shop" can be answered by post, and that in future the Editor will decline to forward sealed letters addressed to writers in "Shop" under initials or pseudonym. This has been rendered necessary by the following letter, recently received from a member of my staff:—"Parties have been writing, wishing me to answer their questions by letter, and not through WORK, offering to pay me well for doing so. But as I wish to act honourably both towards you and towards the readers of WORK, I ask you to again give correspondents to understand that all questions sent to WORK are to be answered through the 'Shop' columns."—ED.

Notes on Hand Saws.—CHOPSTICK writes:—"Having read the article by M. Powis Bale on p. 421, I cannot resist the temptation to write a short criticism of the same, and I will state, at the beginning, that I am speaking from practice, while Mr. Bale is quite evidently speaking from theory alone. First, as to the form of teeth most suitable for different kinds of work. These most decidedly are for a hand saw, which everyone in the trade will know is meant for cutting across the grain only; the form shown in the article at Fig. 1 is the best. For a rip saw, that shown in Fig. 2. As to Fig. 3, it is most unsuitable for a hand saw of any kind, but is the right shape for a cross-cut for cutting logs, but for which is recommended the ridiculous shape shown in Fig. 7. Now as to the size of the teeth. For a hand saw, five teeth to the inch, and for a rip saw, three to the inch, is the best. And now a word or two as to sharpening and setting. The latter should be done first, and I advise everyone to stick to the old-fashioned set, and discard all patent spring delusions. With this and a proper taper saw file (a 4½ in. for a hand saw, and a 6 in. for a rip saw) I can, and so can everyone else if he tries, sharpen a saw so that it will cut any and every kind of wood, which is what is wanted, unless we can afford a separate saw for every kind of wood. In sharpening (after the setting is done, mind), keep the teeth of uniform size, all the same level, and your saw will work clean and easy. A good test is to hold the saw teeth upwards, with the point resting on the bench and the handle about a foot higher, then place a needle on the teeth at the highest point, and it should run to the bottom without falling off. I can sharpen a saw so that it will do so; can the author of the paper? I will guarantee that he cannot, or he would know more of the subject upon which he wrote. One more point I must touch upon, and I have done. It says: 'That for straight-grained wood the square tooth answers fairly well, but for cross-grained the tooth requires to be bevelled.' Now, the fact is just the opposite, which anyone can prove by a trial, though this is much more apparent in machine saws than in hand saws; but the fact is the same, nevertheless. I am sorry to take up space in this way, but I think that we practical men should have our say, as well as those who speak from theory only. The latter is a good thing, no doubt, but practice will stand on its merits, in certain cases, far better."

Sheet Metal Work.—TINKER writes:—"As a reader of WORK from the first number, I read with great pleasure the articles on sheet metal work, and also the replies of Mr. Alexander in 'Shop,' as they are always very concise and to the point. But the best of us make a slip sometimes, and there are one or two little slips that I am sure were not intentional, and which I will point out. In Vol. III., No. 120, p. 252, in answer to BLACKSMITH, *re* oil-bottles, R. A. gives the size of a 2 quart bottle as 19½ in. by 6¾ in.; but that size when made up would hold nearer 3 quarts than 2 quarts. The size to cut a 2 quart oil-bottle is half a double plate, or 17 in. by 6½ in. As I happened to be on a gross at the time, I measured one, and found it held the best part of half a pint over the 2 quarts. There is also a slight slip or two in R. A.'s last paper on 'Oval and Cylindrical Vessels in Sheet Metal Work.' In No. 127, p. 359, in explaining the way to cut the rim for an oval kettle (and it is the correct way), the process explained is all right, but the drawing is wrong (Fig. 12), as there are no straight pieces in the drawing, but all flue, which would convey an opposite impression to the description of the cutting-out of the rim. Also in the bottom line of the middle column, p. 359, R. A. says, 'middle plate cut in two pieces, 17 in. by 17½ in.,' which should be 15 in. by 15½ in. In conclusion, I hope Mr. Alexander will take these little corrections in a right spirit, as I am sure there is nothing comes from him (or any other contributor) but what he honestly believes to be correct, and no doubt he, as I should myself, takes great pleasure in giving others that are not so competent, every possible practical help."

Notes on Hand Saws.—A. R. (*Scorrier*) writes:—"Whenever I see an article on saws, sawing, or on wood-working machinery of any description, it attracts my special attention. Now, one man's opinion may vastly differ from another's practical experience on the same subject. In No. 131, p. 421 of WORK, M. Powis Bale gives his opinion in reference to hand-saw teeth. As the object of WORK is to enlighten its readers, I venture to write as follows, but with due respect to M. Powis Bale: Figs. 1, 2, and 3, on p. 421, represent hand rip saw teeth, of which M. Powis Bale says Fig. 1 is undoubtedly the worst form. Herein I disagree with M. Powis Bale. I will allow that there should be a little more rake than represented in Fig. 1, but not near as much rake as in Figs. 2 and 3, which M. Powis Bale claims to be the better form. I do not hesitate to say that if any man tried to work a hand saw with rake in teeth as represented on p. 421, Figs. 2 and 3, that he found a difficulty in working it, and that if he persisted in working it that his saw soon became buckled. If the readers of WORK have followed the articles by M. Powis Bale on saws, they might have noticed the following statement that the teeth of a circular saw driven by steam-power can be worked with more rake than a vertical or frame saw, because it is driven at a high speed. I suppose there are but few men that have had greater experience in sharpening of circular saws than myself, and the rake represented in Figs. 2 and 3, p. 421, for a saw to be worked by hand, is more than I should give in teeth of a circular saw for general work driven by steam-power. In reference to teeth, Fig. 7, p. 421, I can say nothing of its merits or demerits in reference to its cutting qualities. I believe it is generally understood that the ordinary teeth in two-handle cross-cut saws, if the angles are suitable for the work it has to do, are best. There are many forms of teeth claimed to be of American origin, but even in that country the ordinary teeth are principally used. I might give several reasons why the ordinary tooth is preferred. Again, I might write in reference to the M shape tooth (Fig. 6, p. 421), proving that the general hand-saw tooth is preferred, but defer writing until a future occasion."

Testing Accuracy of Framework.—G. P. (*Elgin*) writes:—"With reference to a communication from J. C. K. (*London, N.W.*), headed 'Testing the Accuracy of Framework' (p. 427), I am exceedingly surprised to see such an erroneous statement made by one usually so accurate as he is. He writes with the intention of showing that the method of testing the accuracy of framework described in p. 326 is incorrect, but only succeeds in showing that the diagonals of a trapezium *may* be equal. Now, Mr. Scott refers to picture-frames and other rectangular objects, namely, objects which have their opposite sides parallel, and their angles right angles. But objects which have their opposite sides parallel have their opposite sides equal; and, therefore, picture-frames must have their opposite sides equal. Now, all

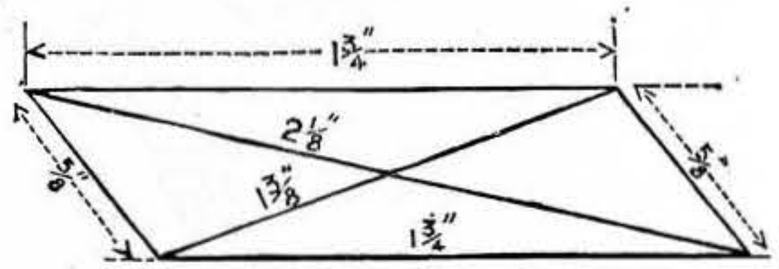


Fig. 1

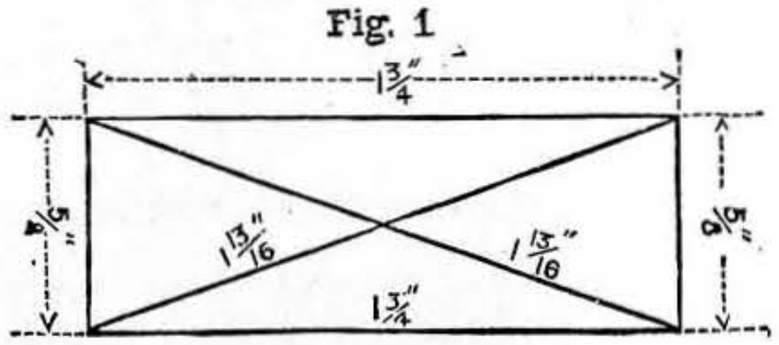


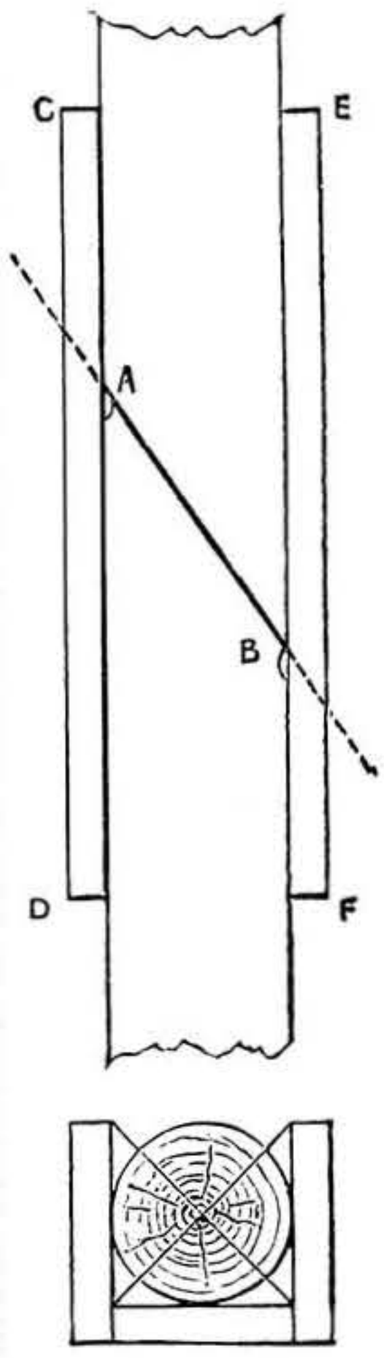
Fig. 2

Diagrams showing how to test Framework.

picture-frame makers that I have ever seen take great care, when making a frame, to make the opposite sides of it equal. They first make the moulding for one side the required length, and then they adjust the moulding for the opposite side until it is exactly the same size. Again, if a figure have its opposite sides equal, but its diagonals unequal, the angles will not be right angles. (Fig. 1.) But if a figure have its opposite sides equal and its diagonals equal, then its angles are bound to be right angles. (Fig. 2.) This can be proved with the aid of Euclid, Book I., as follows: ∠ B A C = ∠ D C A (I. 8). ∴ A B is parallel to D C (I. 27), and A B = C D. ∴ A D is parallel to B C (I. 33). ∴ A B C D is a parallelogram. Now ∠ A D C = ∠ B C D (I. 8). ∴ ∠ A D C = ½ ∠ A D C + ½ ∠ B C D. But ∠ A D C + ∠ B C D = 2 rt. angles (I. 29). ∴ ∠ A D C = 1 rt. ∠; ∴ ∠s D A B, A B C, and B C D are each equal to 1 rt. ∠. I hardly think that J. C. K. will now protest against this method of testing the accuracy of framework, since it is proved here on the strength of information which has been handed down to us from the time of Euclid, about 300 B.C., and the accuracy of which is of such a high standard of excellence that no one has been able to dispute it through all these centuries."

II.—Questions Answered by Editor and Staff.

Splicing a Mast.—NAUTICUS.—I am not clear as to whether NAUTICUS wants to know how to make a "ship's splice," or other method of joining the parts of a mast together, or whether he merely wishes to know how to "scarf" together two pieces of round timber. As the latter method is probably what he requires, I will describe it, merely premising that if correspondents would only state clearly and fully what they wish to know, they would get much more satisfactory replies. NAUTICUS'S difficulty seems to be to draw a straight line over a round. A mast-maker would do this by making a small groove or nick on each side of the mast, as shown at A and B, into each of which a small batten is fixed. With these as a guide, it is easy to draw the line required with a straight-edge.—L. L. H.—[Thus far, my good friend L. L. H.; but supposing that it is the scarfing that NAUTICUS is in difficulty about rather than the splicing or binding the scarfed ends with cord, is it not possible to help him a little more effectually? I think so myself, and that it may be done in this way, and the *modus operandi* shown by adding a little to L. L. H.'s drawing. If NAUTICUS made a wooden trough after the manner of a mitre-box, shown in plan by the steps C D, E F, on each side of L. L. H.'s mast, and in section below, and cut a saw kerf in each step as shown by the dotted lines extending from A and B outwards, taking care that they are truly vertical, he would then, after dropping the pole into the mitre-box, be able to saw each piece across at the same angles to form the scarf without any trouble whatever. If the mast lies too loosely in the box, the pole should be steadied by a small wedge, care being taken to wedge each piece on the same side.—ED.]



Scarfing a Mast shown in Plan and Section.

Printing Type.—W. G. C. (*Sierra Leone*).—Small founts of type are made up and sold by Squintani & Co., Farringdon Street, E.C. Possibly the rubber-faced type made and sold by Richford and Co., Snow Hill, E.C., might suit you better than the ordinary kind.—D. A.

Writing Desk.—A. C. (*Blackfriars*).—Your desk being made of wood ¼ in. thick, and having a margin of only ⅜ in. around the fretted part, I am afraid you will find the difficulty of fastening by dovetails greater than you can get over. It might be done with great care, but would require skilful hands, as there is only ⅛ in. to spare after cutting the sockets. The mitred dovetail would be the neatest and strongest joint in your case, but I can hardly advise you to try it on such delicate work unless you have made it on a larger scale. You might fasten the parts together with screws, but that would not be at all a workman-like plan. The best method for you to adopt will be to mitre the corners. This will prevent end grain being seen, and in appearance will be the same as the mitred dovetailed joint. The strength of a plain mitre, even with glue, will, however, not be sufficient, and must be increased either by keying or blocking. To key the parts together, after having glued them, take a small saw, such as a dovetail saw; cut diagonally from the corners in, say, two places in each. Into each cut then glue a piece of veneer, and when the glue has set, trim off the surplus projecting veneer. This makes a strong joint when properly done. Blocking is easier, and is done by just gluing strips of wood to the inner angles of the desk. I do not know in what way you intend to support or back up the fret. It will be very apt to get broken unless you do something of the kind, as I strongly recommend you to. If you do, then make a box of thin wood, and overlay the fretted parts outside it. The joints of the inner box can be made as strong as you like, while those on the frets can be simply mitred, as the frets will be stuck on with glue.—D. D.

Fine Cutting (Picture-frame Cutting).—If you want to make a fine cut, of course you must use a fine saw. Of course, I am supposing you are possessed of the necessary skill. You cannot do better

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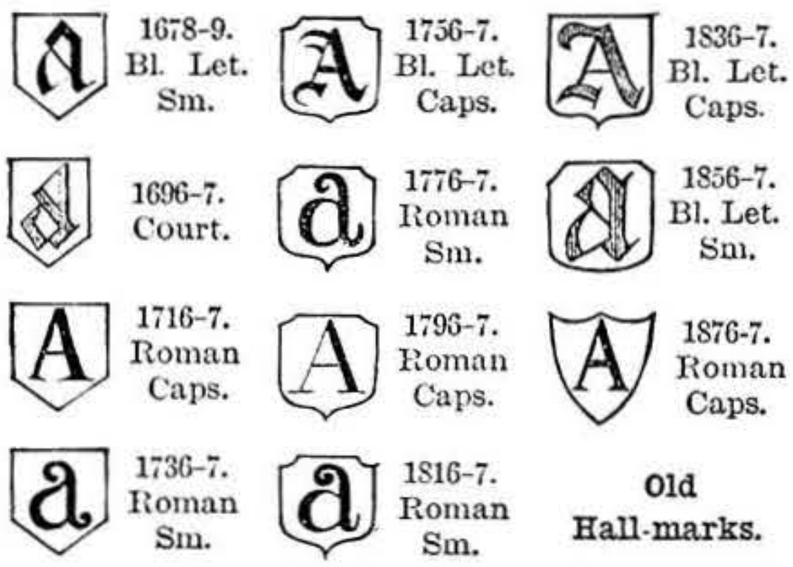
than get one of the Britannia Co.'s circular saw benches.—D. A.

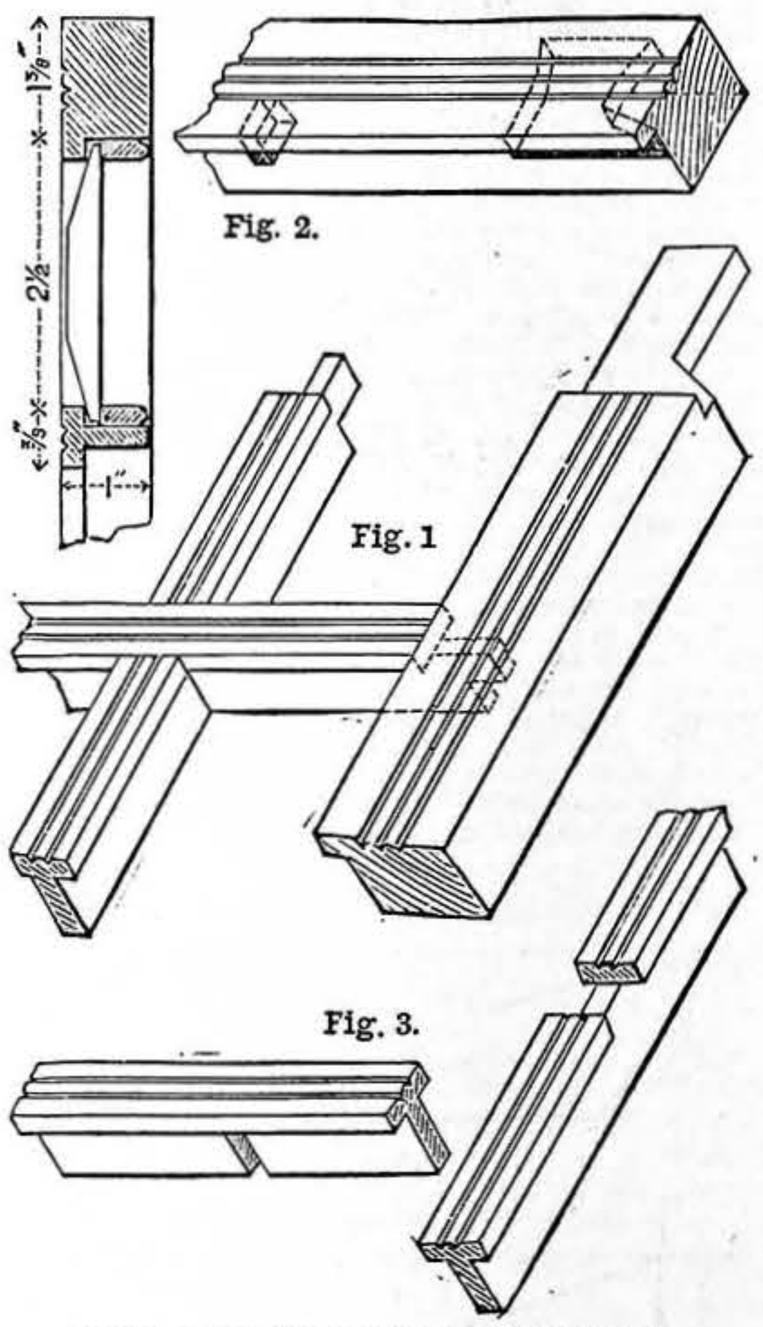
Old Hall-marks.—C. F. (*South Shields*).—If you want the very best books on this subject you will have to get "Hall-marks on Gold and Silver Plate," 6th edition, by W. Chaffers, published at 16s. by Reeves & Turner, 196, Strand, London, W.; or, "Old English Plate," by Wilfrid Joseph Cripps, M.A., F.S.A., published by John Murray, Albemarle Street, at about the same price as the other. Personally, I prefer the "Old English Plate;" it is more readable, and better illustrated. In these books will be found tables of



date letters used in the assay offices of the United Kingdom, with an account of French marks, and many German, Belgian, and Dutch ones; in fact, they are as complete as it is possible to make them, and they are well worth the price they are published at. After these works, the next best is one of the excellent South Kensington Museum handbooks on "Gold and Silversmiths' Work;" it is published at 1s. in a paper cover, 1s. 6d. in cloth, and is printed for the Science and Art Department, South Kensington, to whom application should be made. In that book the matter is very shortly dealt with, and merely the first letter of each cycle of twenty years is given. One alphabet is used in regular order—from A to V, omitting J and U or V; that, of course, will make the number to twenty letters, instead of twenty-six. As neither of these books may be easily got at, I give the first letters and the shields from the cycle beginning 1678-9 up to the present time, the present letter being Q. For details of the first introduction of letters for the makers' mark instead of a symbol, and for several other matters, the shilling book will be found useful; but the others are the ones to possess.—H. S. G.

Sleepers.—CARPENTER (*Durban, Natal*).—In reply to your query only an approximate answer can be given, as the statistics, if obtainable at all from the companies, could only be got with considerable delay. The sleepers on nearly all the lines in Great Britain are placed transversely, with the exception of the Great Western, where the continuous sleeper is in use. There will be in these, together with the transverse pieces for keeping the gauge, almost the same amount of timber as there is in the transverse sleepers of the regular gauge. I have, therefore, reckoned the amount of timber in the broad gauge as if the sleepers were laid transversely, as on the other lines; and as next May the B. G. will entirely disappear from this island of ours, I shall not be much out. The following paragraph, taken from "The Working and Management of an English Railway," by Findlay (of the London and North-Western Railway), one of the best authorities of the day on such subjects, will be useful to you:—"The improved form of permanent way actually in use upon the London and North-Western Railway at the present time. It consists of wooden sleepers laid transversely, and which are of well-seasoned Baltic timber, into which creosote oil has been forced under pressure to the extent of 3¾ gallons to each sleeper. The sleeper, which is 9 ft. long by 10 in. wide by 5 in. deep, when creosoted weighs 150 to 160 lbs. Each 30 ft. of rail rests on ten sleepers. A certain number of iron and steel sleepers have been laid down on the London and North-Western Railway experimentally, the first step having been taken eight years ago. The results have been varied, a percentage of the sleepers having failed, while, on the other hand, a larger percentage appear to be standing well." From the above it appears that the sleepers are 3 ft. apart, so, as this railway is under extremely good management, I shall consider this as the average pitch for the sleepers on all the railways in Great Britain, the sleepers on some lines being closer while on others they are wider apart. Now the number of miles of railway in Great Britain open for traffic at the present time is 16,144·75. Taking the sleepers at 3 ft. pitch, we obtain the grand total of 28,414,760 sleepers for a single line of rail. The life of a sleeper varies greatly and from several causes. Sleepers cut from the same kind of trees, grown on almost the same spot, vary very considerably; those cut from trees growing in the valley and damp ground standing much less wear and tear than those obtained from the same class of tree growing higher up on the hill or mountain side. Again, sleepers obtained from trees grown under precisely the same conditions vary as regards length of life, on account of the positions they occupy on the line, those most subject to alternations of moisture and dryness, and heat and cold, decaying much faster than those placed under more favourable conditions, especially as regards drainage. One of the most favourable conditions of a line, for lengthening the life of the sleepers, is to have it thoroughly well drained. The length of life again varies with the species of wood; oak, though too dear to be used in this country, lasts much longer than any other kind. From particulars obtained from a good authority, I find that a sleeper decays and is useless any time between three and twenty-five years, according to the above conditions; so I think if I take eight years as the average life I shall not be far wrong. If we now divide the total number of sleepers in use on our railways by 8, we shall obtain 3,551,845, or over 3½ millions yearly, as the number actually needed to replace the worn-out ones on a single line, but all railways in Great Britain have double lines, with the exception of a very small percentage which will be entirely counterbalanced by those lines which have four sets of lines, so that we must double the 3½ millions, when we obtain the great number of over 7 million sleepers needed yearly. This, of course, takes no account of the sleepers used in the miles of sidings. Baltic fir and similar classes of timber are almost universally used in Great Britain, and the method of preserving them by injecting creosote oil is the general method employed. The timber used comes from the Baltic provinces, Norway, Sweden, and America. The home forests would not supply the smallest fraction of the timber needed. Indeed, there are no forests here in your sense of the term.—P. B. H.

Bookcase.—S. C. (*Ashton-under-Lyne*).—I give you three sketches, showing how the doors are mortised, together with the measurements as far as I can. The height and width of your doors you must decide for yourself, as you alone know what



Mode of Mortising Doors of Bookcase.

size the bookcase is. Those referred to are about 2 ft. 6 in. wide, by 2 ft. 2 in. high out to out. Fig. 1 shows part of one top rail, style, and two bars. Fig. 2 is a section through one style and one bar, showing how the glass is fixed in, etc. Fig. 3 shows an easy way of making the joint where the bars meet. The fronts of the horizontal bars are housed out, and the backs of the vertical bars are notched out to pass over the part left on the horizontal bar. Any turner will do the turning required; it is a very simple job. You will not have any difficulty in getting the bevelled glass in Manchester; but as the glass is rather a serious item, I should advise you to make inquiries as to price at several glass merchants. If any other troubles crop up as you go along, let me know, and I shall have much pleasure in putting you right.—E. D.

Bicycle Tires.—W. H. F. (*Rye*).—If you have an invention that will prevent pneumatic tires being punctured, and that makes the tire independent of compressed air, then you have hit upon something that any of the makers of tires will be glad to hear about, as that is just what they have been as yet in vain trying to discover. Write to the Dunlop Pneumatic Tire Company, Dublin; or the Clincher Tire Company, Edinburgh. The firm mentioned by you is unknown to me. You could communicate with Brown Bros., 7, Great Eastern Street, a firm which I know to be reliable.—A. S. P.

Stoving Enamel.—W. W. (*Manchester*).—Stoving enamel can be had in two tins for first and second coats for about 1s. a tin. Time on stove, one hour at 300 degrees of heat. The tins are labelled to show which to apply first. The two tins sufficient for one bicycle.—A. S. P.

Mounting Etchings.—W. F. B. (*Rochester*).—Surely your own ideas of the fitness of things ought to be sufficient to tell you how to paste etchings, etc., in a book. The colour of the paper must depend entirely on the nature of the etching, drawing, or painting; white, cream, and grey would seem to be the most appropriate. It must depend on your own judgment entirely whether or not you surround them with lines disposed in the form of an Oxford frame.

Lithographic Printing.—A BEGINNER.—Papers on the "Art of Lithography" are now appearing in WORK, and will soon be completed; but up to the present time no articles have appeared on lithographic printing.

Slimy Sponge.—A BEGINNER.—Wash your sponge well in hot soda water with a little soap, then rinse it well in cold water, squeeze the water well out of it, and let it dry. This done, use it as a sponge with water only and not with soap, and squeeze the water well out of it before putting it again into the sponge dish.

Mail Cart.—A NEW READER.—You will find directions for building a mail cart in No. 30 of WORK, and a reply to a correspondent respecting mail-cart wheels in No. 51.

Bicycles.—F. S. (*Kidderminster*).—It is probably as well that you and your friends gave up solving the puzzle of the bicycle, and it would have saved some time, no doubt, if you had never attempted it, especially when it was plainly visible that the description had not been written by a man who was of a mechanical turn. To get you out of your difficulty I send sketches and a condensed description of the specification. What the inventor intends to gain by his arrangement I do not know, as the seat must be thrown very far back, and the ordinary chain driving seems to me far more mechanical and a great deal simpler. The condensed specification runs as follows:—"My improvement consists in contracting the hub so that the main driving spindle shall pass through the wheel and toothed hub revolving round the spindle. The spindle carries an internal toothed wheel, the teeth being semi-circular and gearing into similar teeth on the hub on one side of the wheel. I make a drum or hub of suitable size, D (Fig. 1), having teeth on the outside, T, into which drum I place a disc or cone, C, at each end. Fig. 2 shows a side elevation, with a few spokes and rim of wheel, the cones being joined together by a spindle, J, extending above and below crank, K, the said disc or cones being made suitable for ball bearings, now in general use. The said discs being eccentric, and having the hole bored near the edge, E, I place the driving spindle, S, in and through, the said spindle carrying an internal toothed gear wheel, G, so slipping into, or engaging, with the teeth on the drum, D; the said toothed gear wheel, G (Figs. 1 and 2), on the spindle exceeding the size of the one

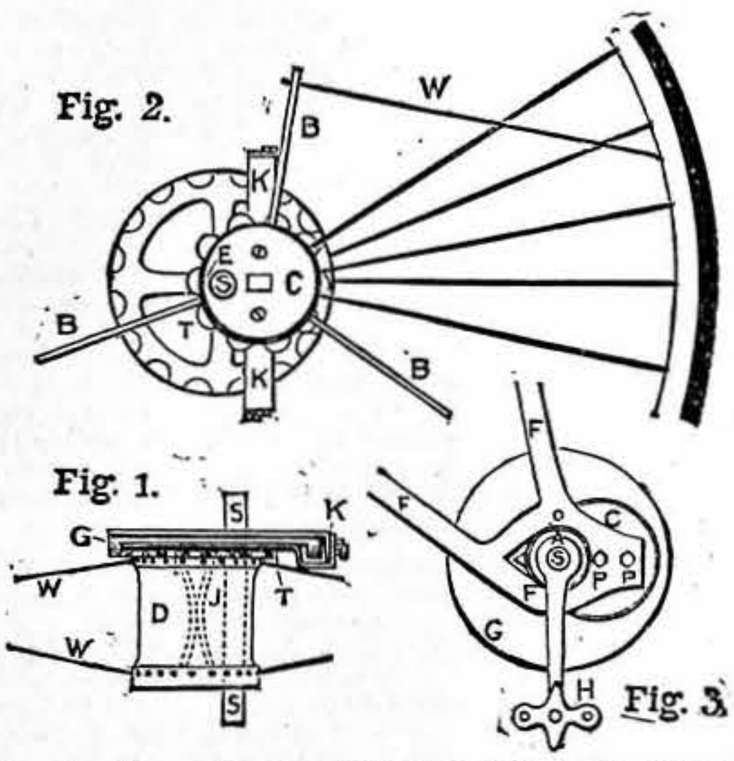


Fig. 1.—Plan. Fig. 2.—Side Elevation, Frame and Cranks removed. Fig. 3.—Side Elevation.

on the drum, or hub, D, according as the eccentric is placed out of the centre of the disc, C, aforesaid. The gear wheel would be placed in the space O, between the cranks, K, in Fig. 1; the double crank running round the gear wheel is placed on the outside. The gear wheel, drum, and wheel being complete, I secure them to the frame fork ends, F (Fig. 3), or angle arms, by pins, P, to the cones, C; the spindle moving in bearings, A, in or on the said fork ends of frame, H, the pedals, F, being movable on C to gear up." Some of the letters marked on the drawings are not explained in specification. The above is what appears in the specification, and, as I said before, where the improvement is, I can't see, but you will be able to see for yourself.—P. B. H.

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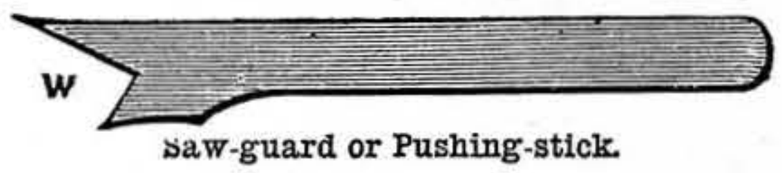
Guard.—SAW-GUARD MAKER.—I know of no maker of a guard such as you require, and am of opinion that should such a guard be invented it would be a disadvantage, as in feeding timber to a circular saw the hands should be perfectly free. To be satisfied that there is no maker of such a guard, I wrote to one of the principal firms of wood-working machinery in England, and received the following reply :—

"DEAR SIR,—We have your favour of the 12th inst., but regret we are not acquainted with any guard suitable for the purpose you require, or we should be glad to give you the information desired."

In cutting thin, and especially short, stuff, we always use a pushing-stick in form of annexed sketch. The stick is from 12 in. to 15 in. long, and



Saw-guard or Pushing-stick.

when the saw is nearly through the cut, the stick, which is kept on the bench and near the right hand, is used by placing the end, W, against the piece of wood being sawn, and the piece is pushed to the saw without endangering the right hand. The left hand merely steadies the outside piece. In reference to your shield—not being able to cut above 10 in. deep with it—I suppose your bench is made to carry saws that will cut up to 10 in. deep, and your shield is made in accordance with it. Should you write Mr. Taylor, stating what you require, he may supply you with a shield suitable for larger saws. If I were near by so that I could see your bench, I might be able to suggest something. I might say that for the work you have to do, I would strongly recommend a band saw; you would find it a great advantage.—A. R.

Cement.—W. J. C. P. (*No Address*).—The query about a cement to resist "heat and moisture when applied to broken ware" is decidedly vague, and I was at the outset considerably puzzled by "the stitches which appear like lead on both sides." Anyhow, by a process of exhaustion, and by the noting down of things that W. J. C. P. seems not to mean, I have arrived at some sort of idea of what he does mean. As W. J. C. P. hails from Jersey, he probably means by "ware" the earthenware marmites such as are used for the preparation of bouillon; by "heat," when applied to broken ware, he probably means the fire; and by "moisture," the contents of the vessel which eventually will be served up as soup. This is all I can find in the query to go upon. The "stitches which appear like lead on both sides and do not show where or how the stitch is joined" are undoubtedly what are known to the initiated as rivets, and the leaden appearance is perhaps to be explained by the fact that the brass wire which was used for the rivets was tinned over to prevent any possible action of acid on the wire. As to this method of "stitching" broken ware, I cannot do better than refer W. J. C. P. (and so save my own time and space in WORK) to No. 53 of WORK—that is, page 4, Vol. II.—where he will find full instructions and diagrams of all the tools required. Now to go back to the cement question. It is not easy to give any advice without knowing what the ware is and where the crack or fracture lies. If a portion of the rim of a vessel is broken out, white-lead spread upon tape, and wrapped round the article, makes an almost unbreakable joint when thoroughly dry and hard, or, to keep up W. J. C. P.'s metaphor, will make a most serviceable kind of "patch" on the ware; this is assuming that the personal appearance of the ware after mending does not matter very much. Marble or alabaster, scraped into a fine powder and mixed up into a thin creamy paste with gum (the best and purest that can be got), make an excellent cement that will stand heat and a certain amount of moisture. It answers, to my personal knowledge, in positions such as the handle of a brown earthenware teapot, but I question whether it would stand the direct heat of a fire at all. I have heard, and read too somewhere or other, that if the outer discoloured portion of an oyster shell be removed, the white, flaky stuff inside, ground to flour and mixed with white of egg, forms an exceedingly good cement, and will withstand moisture and heat. In composition it, of course, resembles the one I have mentioned above. If the article W. J. C. P. wishes to mend is at all heavy, and it is to be lifted on and off the fire with any weight of liquid in it, I should advise him to rivet it in addition to any cement he may decide to use. This reply may seem long, but is mainly the fault of W. J. C. P.'s badly expressed query.—H. J. L. J. M.

Inspectorship of Factory, etc.—A FAITHFUL READER.—I regret that it is not in my power to tell you "the things required to obtain a situation as factory or workshop inspector, where to apply, and when examinations are held, if any."

Tips.—G. F. J. (*London, W.*).—I well know the difficulty there is in getting a good shape tip for London West-End bespoke work. I have made every inquiry, but failed to find a man. This answer will be read by a good many practical workers in iron and brass; it may prove of some use to you and many others. A good shape being one of the greatest drawbacks to the production of good tips by men not acquainted with the boot trade, I will undertake to give, free of charge, to any workman (the Editor has my address), paper patterns, or drawings, of good and fashionable-shaped heels, and hints as to what is really wanted. It is a long-felt want that has never been supplied, and having suffered under it myself, I am willing to do all I can in the matter. It is a good opening for some energetic reader of WORK.—W. G.

Pack Sheeting.—R. S. (*Darwen*).—It will depend a good deal on the quality of the wrappers whether you could treat and utilise them as floor-cloth. They might be made available for the purpose, but I am afraid you would find in the end that they would cost you far more than if you were to buy the floor-cloth ready. If you want to use them up in this way, try painting them with several thick coats of oil paint; but without proper plant it will be hopeless for you to try to make anything like a good floor-cloth. With regard to the mark on your table a good deal will depend on the extent of the injury. If it is slight, and the polish only is damaged, it may be only necessary to touch up with French polish. On the other hand, if the wood is injured, you will have to scrape or paper down, or even to plane off the surface and repolish the top as if it were new.—D. D.

Anti-vibrator.—DENNISTONE.—The "difficulty" which you have anticipated in respect of the brake action being interfered with may be got over by the arrangement shown in accompanying drawing. If the brake at present on your machine is long enough when full on to reach the wheel when the spring is extended to its fullest, you need not alter it, but can get over the difficulty by attaching foot-rests to the ends of levers, as shown at D, Figs. 1 and 3, by which you may apply the brake with your feet and hand combined. If your brake-

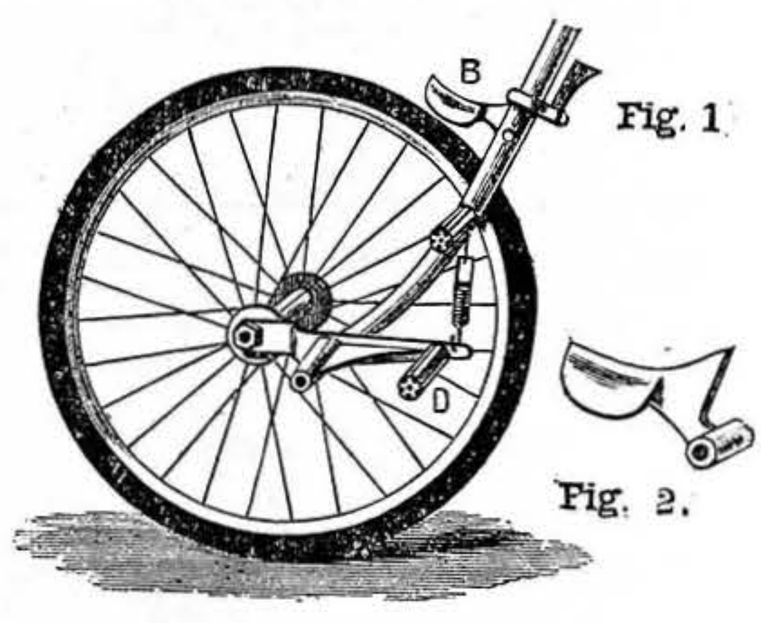


Fig. 1

Fig. 2.

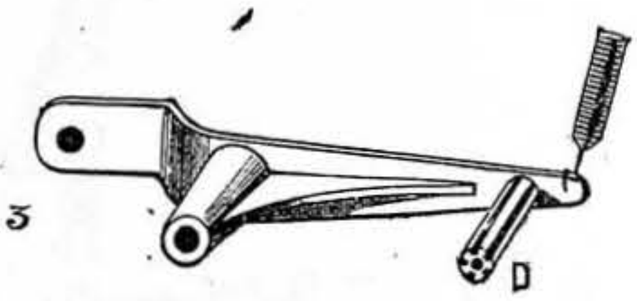


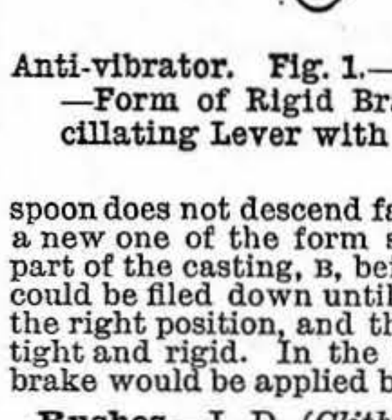
Fig. 3

Anti-vibrator. Fig. 1.—Wheel complete. Fig. 2.—Form of Rigid Brake-spoon. Fig. 3.—Oscillating Lever with Foot-rest attached.

spoon does not descend far enough, you could make a new one of the form shown at Fig. 2; the back part of the casting, B, being made far enough back, could be filed down until the brake-spoon rested in the right position, and then the whole screwed up tight and rigid. In the latter case, of course, the brake would be applied by the feet only.—CYCLOPS.

Rushes.—J. D. (*Clitheroe*).—The best and most practical advice I can give you if you want to reseat with rushes is when undoing a seat to notice how the rushes are twisted, and copy the method.—D. D.

Saw Hammering.—J. S. (*Keighley*).—You wish to know the difference in the effects of a blow on a saw-plate when struck with the cross-faced hammer and when struck with the dog-head hammer. The cross-faced hammer is used for straightening and not to regulate the tension of the plate; a saw-plate may be perfectly true, but of unequal tension, which may not be discovered until the saw has been set to work. Unequal tension may be discovered by bending the plate with the hands, as stated in WORK, No. 119, p. 235. This may be removed by using the dog-head hammer, the face of which is rounded so that the effects of its blows will extend equally as shown at C in this sketch of a circular saw. The effects of blows delivered by the cross-head hammer will be as at A and B. The blow at A will be struck with the transverse face of the hammer, and the blow at B with the face parallel to the handle. In some cases the cross-faced hammer will generate a similar effect to that of the dog-head hammer, by striking first with one face and then with the other face of the hammer, crossing the blows, distributing the hammer effects more equally than if the blows were in one direction. In WORK, No. 119, p. 235, I gave instructions as to how to take out a loose place in a circular saw. It may be taken out with the dog-head hammer alone; but it must be understood that sometimes a loose place is caused when it cannot be taken out with the dog-head hammer, and the cross-faced hammer has to be used. I refer to a place caused by over-heating when working the saw, causing blister.—A. R.



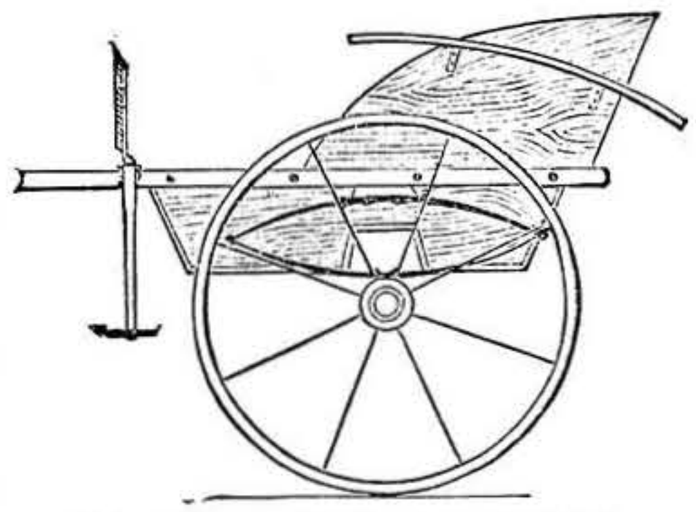
Saw Hammering.

Stain.—W. J. H. (*Reading*).—I fancy you have been misled as to the name of the stain you require, acacia being the technical name for gum arabic, which is rarely used for staining purposes; but this gives no clue to the colour you require. If you can send us a sample of the colour, I shall be pleased to assist; meantime, read carefully through "Shop" for the last three months. Many hints appear on staining and varnishing walking-sticks, which are equally applicable to umbrellas.—LIFEBOAT.

Painting Texts for Church Walls.—G. M. H. (*Derbyshire*).—Yes, they are commonly painted on zinc. From this you should have your scrolls cut, and, as far as possible, so arrange them that the joinings may come where the "returns" and "turnovers" of the scrolls occur. Both for painting and fixing, you will find it more convenient to have your work in detached pieces than to have the whole soldered together before beginning. Sheet zinc is sold by the pound, and the price per foot will vary with the gauge; but you may roughly set it down at 1½d. or 2d. Zinc texts look best fixed up with plain brass-headed nails. As ground colour, scarcely any other than buff is in ordinary use; but care should be taken that it does not too nearly approach the colour of the walls. What is called a "blush buff" will tell best on some walls, on others a greyer tone will be more effective. On the turnovers a positive ground colour will be used. When the ground is thoroughly dry, the gilding should be first put in, and to prevent the gold leaf from sticking in wrong places, adjacent parts should be dusted over with powdered whiting. All gold work should be boldly outlined with black, as should also the edge of the scroll, so as to cut it off distinctly from the wall. G. M. H. will find choice of alphabets published for church decorative work. The characters are most readily put in with stencil plates, and finished with the brush. Sacred names and initials are usually put in with gold or red, and subordinate characters with blue. The drawback to zinc is that it is liable to cockle, and the text may instead be painted direct on the wall itself. The space to be painted has first to be gone over with a preparation, which stops suction and prevents damp coming through. This is made by dissolving gutta-percha and shellac in naphtha: the solution must be so thin as to work freely, but not so thin as to run. When this method is employed, texts are often painted without scroll-work, and in that case the lettering is set out on the wall, and each separate letter is first painted over with the solution, and again, when this is dry, with colour.—S. W.

Anti-vibrator.—W. E. H. (*No Address*).—You are right in supposing that on lifting the machine the wheel would drop down; but obviously it could not drop more than 2 in. If you object to this, you could screw a stop-pin in the fork side just above where the lever rests, so as to catch it when going too far up. With reference to the wheel catching the mud-guard, its altered position places it so much further away from the fork top and guard that you need not fear this happening, provided you have the spring strong enough.—CYCLOPS.

Oxford Cart.—G. J. W. (*Antrim*).—I cannot form a very clear idea of what you want, either from the name you give or from your sketch.



Oxford Cart. (Scale, ⅓ in. to 1 ft.)

From the latter, however, I gather that the cart you require is to carry two persons only. I therefore give a sketch of a simple and easily built vehicle (scale, ⅓ in. to a foot), and refer you to Vol. I., No. 19, p. 295, where you will find an article on a "Battlesden" cart, which will help you, as many of the details are similar. To give dimensions of the various parts would occupy too much space for these columns; besides, these will altogether depend upon the size of the animal you intend the cart to suit. But if you follow the scale given, you will

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have a cart for a "polo-pony" size—*i.e.*, 14 hands high.—OPIFEX.

Papers for Watchmakers.—E. T.—There is the *Horological Journal*, published monthly (1st of each month), at Northampton Square, Clerkenwell (price 3d.), which may be had through any bookseller, or direct from the Secretary, Horological Institute, as above. I have taken it the last twelve years, and find it very useful. Then there is the *Watchmaker, Jeweller, and Silversmith*, published at 68, Fleet Street, London (5s. per annum, or 6d. monthly), in which useful information is to be had. I know of no others of much utility.—A. B. C.

III.—QUESTIONS SUBMITTED TO CORRESPONDENTS.

Spray Diffuser.—POTTER writes:—"Will any reader give me directions for making a machine to work by hand for blowing insecticides in the form of fine spray, as it is very much wanted in large greenhouses?"

Measurement of Paraffin Barrels.—PARAFFIN writes:—"Will you inform me through WORK how the measurement is reckoned in paraffin barrels? For instance, on the end of the barrel is '120 tests;' what is the meaning, and how is it reckoned?"

To Preserve Stone.—H. L. P. (*Montrose*) asks:—"What is the best preservative to prevent from decay a church steeple built of carboniferous sandstone and exposed to the sea air? Has it been used anywhere with success?"

Coal-dust Bricks.—G. R. (*Swinton*) asks:—"Will any reader of WORK kindly inform me what the coal-dust bricks are made of? I understand they are made of coal-dust, pitch, and other ingredients, but what are the component parts? Is it a patent? If so, who is the patentee and manufacturer?"

Heating Small Greenhouse.—NEWLAND asks:—"Will some reader of WORK kindly tell me how I can fit a heating apparatus to two Rippingill oil stoves with 3 in. burners? I want to keep the frost out of a small greenhouse 12 ft. by 5½ ft. The stoves by themselves are not sufficient. I think some system of a boiler and piping might answer, but I do not understand the working of a hot-water apparatus."

IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

Bread-cutter.—C. P. WEBB writes, in reply to JEAN (see No. 127, page 366):—"A simple bread-cutting machine may be constructed as follows: Take a piece of beech, or other hard wood, 18 in. by 12 in. by 1 in., planed smooth, and nicely squared; then take a strip of iron, ⅛ in. thick, ¾ in. wide, 19 in. long; heat one end and bend up 1 in. close, then bend up the whole in half, so that you leave a space between the two sides of ⅛ in., as shown at A (Fig. 1); drill two holes, countersunk one side as shown, on one of the shorter sides of the board at 1¼ in. from the side; cut out a piece ¾ in. wide by ⅜ in. deep; screw this piece of ironwork on, as at A (Fig. 2). Now cut two pieces of the same iron—one 2 in. long, the other 7 in. long; drill a hole at ½ in. from each end of the longer piece, and a hole ½ in. from one end of the shorter piece, and two holes—countersunk—at the other end; cut a small piece, ¾ in. wide and ⅛ in. deep, out of the side of

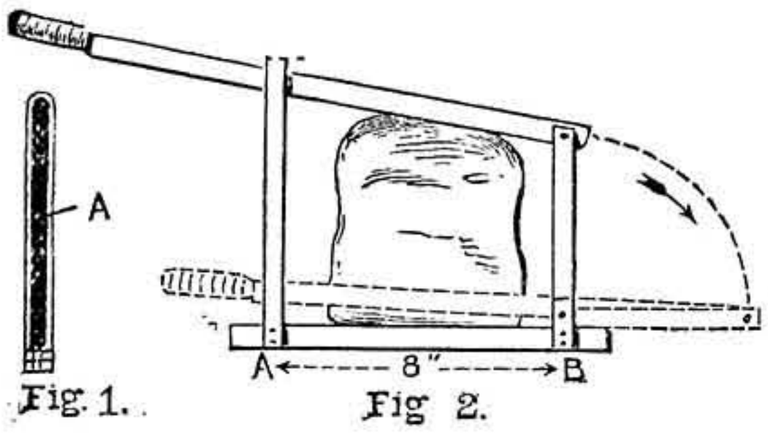

Fig. 1. Fig 2.

Fig. 1.—Guide for Knife. Fig. 2.—Machine complete.

the wood base at 8 in. clear from the other. Rivet these two pieces together, so that they work easily, and screw them on to the block as at B (Fig. 2). Now take a knife, with a blade stout and sharp, and about 16 in. long; at about ½ in. from the point drill a hole. Pass the blade through the groove in the upright, edge downwards, and rivet it loosely to the end of the iron at the other side. All this will be better understood by a reference to the sketches. The machine is now completed. To use same, place the loaf on the board, just overlapping, and with one motion press and push the knife by the handle, which will cut off a slice; lift the knife and repeat until the whole is cut up."

Heliograph.—C. P. WEBB writes, in reply to R. N. (see No. 129, page 398):—This little instrument is used for the purpose of signalling by means of flashing the reflection of the sun's rays, according to a pre-arranged code, and is most simple in its general principles of construction. I am not cognisant of the details of the instrument in use in the Army Signalling Department, but one made in accordance with the following instructions will be found thoroughly effective: Take two pieces of any hard wood, say, 12 in. square, and hinge them together on one side so that they open in the form of a book; at the opposite side, and about 1½ in. from the edge, place a small thumb-screw for the purpose of opening and closing the boards to give proper elevation to the instrument. Now procure a small circular mirror, 6 in. diameter, fitted into a tin back and rim, which can be obtained at a turnery or hairdresser's shop. From the exact centre of the tin back cut out a circle 1 in. in diameter and clean off the quicksilver from this space at the back of the glass; this is for the purpose of seeing from the back that the mirror is directed towards the spot it is desired to signal to. Draw a line across the back, and at each end, close to the edge, solder a very small ring, also a similar ring on the edge half-way between the two; the positions are indicated in Fig. 1, A, B, C. Now take two strips of iron—say ⅛ in. thick, ¾ in. wide, and 9 in. long—and bend them as shown at E and F (Fig. 1). Drill small holes through them, G, H, I, J, K, L, and rivet them together at H and I. This will be fully shown by a reference to the sketch. Take a steel knitting-needle, pass it through the hole J, then through the two side rings at the back of the mirror and through the hole K; secure the ends that it does not slip out. The glass will now swing in a frame, as it were. Affix this portion

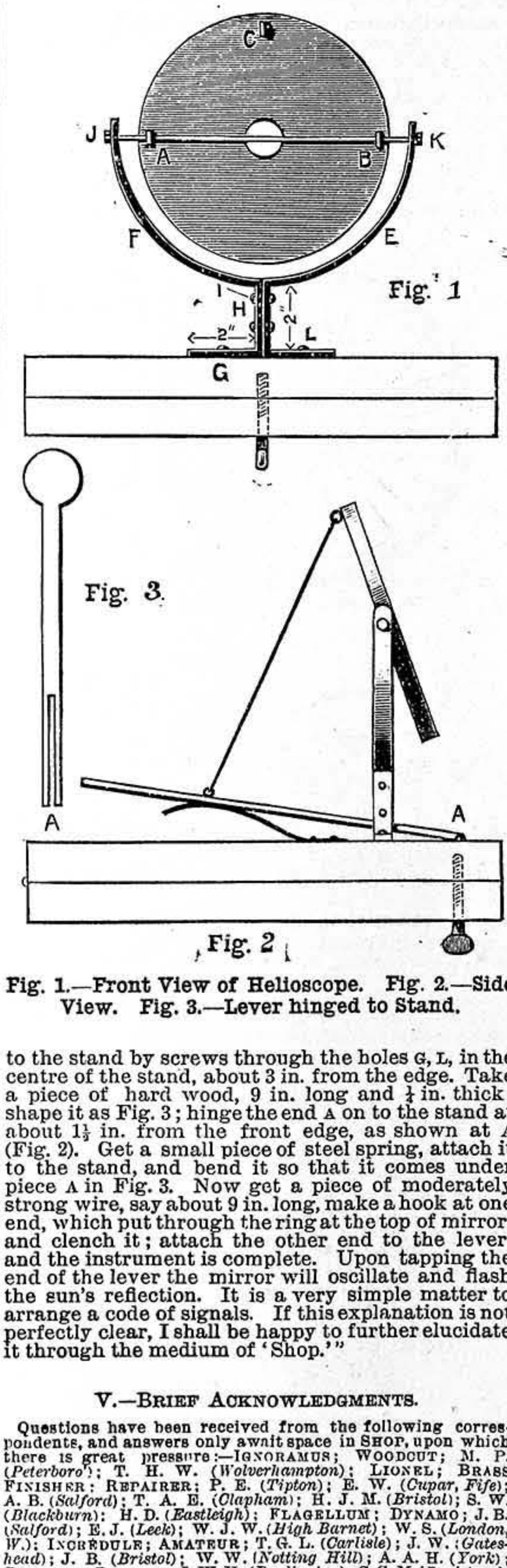

Fig. 1

Fig. 3.

Fig. 2

Fig. 1.—Front View of Helioscope. Fig. 2.—Side View. Fig. 3.—Lever hinged to Stand.

to the stand by screws through the holes G, L, in the centre of the stand, about 3 in. from the edge. Take a piece of hard wood, 9 in. long and ¼ in. thick; shape it as Fig. 3; hinge the end A on to the stand at about 1½ in. from the front edge, as shown at A (Fig. 2). Get a small piece of steel spring, attach it to the stand, and bend it so that it comes under piece A in Fig. 3. Now get a piece of moderately strong wire, say about 9 in. long, make a hook at one end, which put through the ring at the top of mirror, and clench it; attach the other end to the lever, and the instrument is complete. Upon tapping the end of the lever the mirror will oscillate and flash the sun's reflection. It is a very simple matter to arrange a code of signals. If this explanation is not perfectly clear, I shall be happy to further elucidate it through the medium of 'Shop.'"

V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—IGNORAMUS; WOODCUT; M. P. (*Peterboro'*); T. H. W. (*Wolverhampton*); LIONEL; BRASS FINISHER: REPAIRER; P. E. (*Tipton*); E. W. (*Cupar, Fife*); A. B. (*Salford*); T. A. E. (*Clapham*); H. J. M. (*Bristol*); S. W. (*Blackburn*); H. D. (*Eastleigh*); FLAGELLUM; DYNAMO; J. B. (*Salford*); E. J. (*Leek*); W. J. W. (*High Barnet*); W. S. (*London, W.*); INCREDULE; AMATEUR; T. G. L. (*Carlisle*); J. W. (*Gateshead*); J. B. (*Bristol*); W. W. (*Notting Hill*); A. A. H. (*York*); CONSTANT READER; J. W. H. (*Darlington*); C. G. M. (*Penistone*); M. H. (*Southwick*); OLD CHIP; GLASS; J. E. B. (*Chesterton*); P. B. (*Wandsworth, S.W.*); R. H. (*Barnsbury*); W. H. (*Birmingham*); F. P. (*London, E.*); J. G. (*Swansea*); E. L. (*Dudley*); F. H. (*Battersea, S.W.*); E. H. (*Rawden*); A. B. (*Manchester*); ANSONIA; WALLACE; ENQUIRER; H. J. L. J. M. (*London, W.*); H. B. S. (*Liverpool*); QUARTO; MART; T. A. (*Shobley Bridge*); W. H. S. (*Whaley Bridge*); C. W. T. (*Manchester*); RETRENCHMENT; W. O. J. (*Carnarvon*).

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